the OIL AND GAS JOURNAL

MAY 5, 1958

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Texaco Will Drill Two Wildcats In No Man's Land Off Louisiana

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IMPORTS CONTROLS—

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Three Good Strikes Boom Prospects for

Sahara Desert

"Zarzaitine could outshine Edjele" p. 91

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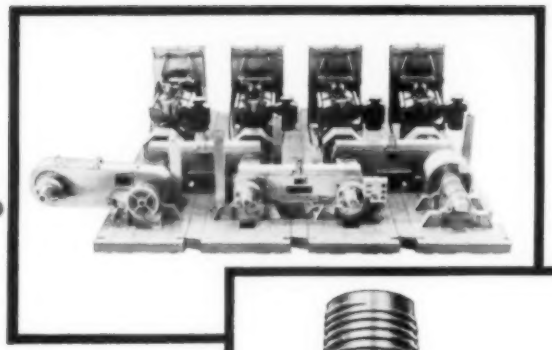

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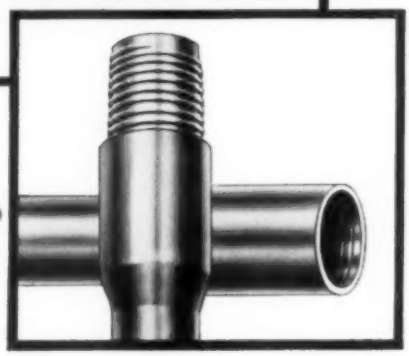

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THE WORLD'S LARGEST INDEPENDENT OIL FIELD SUPPLY COMPANY

the OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
May 5, 1958

The "Memphis" blues are fading for gas pipeliners:

Ways now are being found to live with the hated Circuit Court of Appeals ruling.

The upshot:

Gloom is lifting in this sector of the industry.

Companies are now talking more and more about speeding up construction this summer and fall, spilling into next year.

Outlook clearly is for an earlier-than-expected return to the gas industry's normal growth pattern.

Memphis ruling still works hardships—no denying it.

The decision required prior customer approval of any new rates. It delayed hundreds of millions of dollars in line construction.

Several transmission companies recently accomplished what they thought impossible. They negotiated new rate agreements even where as many as a hundred customers were involved.

Some have paid a high price for the agreement. They have compromised rates more than they first thought prudent. They figured it was a cheap way, however, to save a year's time in their expansion work.

Some distributing companies still are taking advantage of the court ruling to hold out for rates which will not support line expansions. More and more a realistic view seems to be prevailing, however. Distributors generally want more gas as badly as suppliers want to serve them.

The development is important for the gas industry.

For in event the Memphis case is upheld by the Supreme Court, the pattern for living under the revolutionary new regulation will already have been established.

Exploration activity is far from dead. April drilling events prove that (p. 176).

The deep South came to life with three developments: Discovery of first Cotton Valley-Jurassic oil in Mississippi, extension of Alabama's Citronelle field, and new activity in the Black Warrior basin.

In other regions: New gas reserves were found in western Canada...Drilling records set in the Rockies...Fast-moving play set in near Spindletop in Texas...East Texas got a new

Smackover producer...Tejon area of California had new success ...Ordovician and Pennsylvanian discoveries were made in Oklahoma...The Paradox basin was extended in Utah...New enthusiasm was felt for Wyoming's Green River and Powder River basins.

It was a month of high-caliber wildcatting.

Disputed lease in the gulf near Marsh Island finally will be drilled after 20 years of controversy (p. 72).

The Texas Co. has already made locations in the great uncharted waters after getting validation from U. S. Government of the state lease. Government ruling set limits of the lease at 3 leagues from shore, despite all previous federal contentions that state boundaries end at 3 miles from shore.

Enormous interest will surround the drilling.

Texaco's competitors who have prospected in the area say the disputed lease holds some "hellacious structures." Proposed drill sites naturally are over some of the most favorable of these prospects.

Drilling rigs will move back into the metropolitan Los Angeles area this summer after being thwarted from hunting oil within the city for 30 years (p. 68).

Seven locations already made include golf courses, movie studio lots, residential, and industrial districts of the city and its suburbs.

Goal is deeper zones in the Los Angeles Basin passed by years ago because of primitive equipment and techniques.

A technical case history is now available on the deepest hole ever drilled with air (p. 109).

Well is Hunt 1 Bustin Canon in Terrell County, Texas. It was carried to 14,759 ft. with all but 900 ft. of hole drilled with air as circulating fluid.

Contractor took only 86 days and 50 bits to get there.

Geophysical activity stepped up last year in Eastern Hemisphere and South America. Latest statistics add fresh evidence to increased oil operations abroad (p. 80).

Report made by special SEG committee shows:

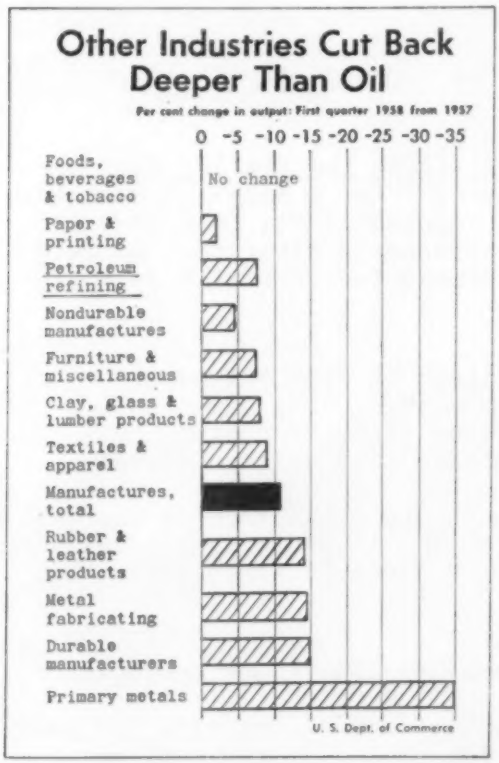
...15% jump in work of geophysical crews in the Eastern Hemisphere.

...1.2% decrease in geophysical activity worldwide chiefly due to 5.3% domestic drop and 8.5% Canadian drop.

France has a third oil field in the Sahara which may prove just as important as Hassi Messaoud (p. 89).

New Zarzaitine find has high quality crude, occurs at shallower depths at less cost, and has a higher rate of recovery of oil in place than Hassi Messaoud.

Moving Zarzaitine crude, however, will prove just as



There's some comfort in this chart. It shows the 8% refining cutback is less than slowdown suffered by many other U. S. industries.

You must remember, however, two facts about refining: You are comparing the first quarter this year to a period in 1957 when activity was high due to Suez...Cuts also are in part due to an unusual stock buildup in last half of 1957.

Refinery runs for current week were 6,984,000 bbl. daily compared with 7,634,000 for same period last year. It's lowest week since late 1954.

Outlook for rest of year: Runs off 5.4% in second quarter, off 2.1% in third, up by 3% in fourth.

frustrating for the French as getting the other oil to port has been.

Within 2 years, nearly all of Spraberry will be flooded. Big operators now are planning seven major units taking in 250,000 or more acres. Sohio Petroleum is leading the big push to unitize. Its unit may develop into world's largest.

Reason for the flood fever: Pilot tests indicate the operators in the ailing field can double and triple their primary production by injecting water (p. 63).

Jet fuel purchased by the military later this year will have to pass a thermal stability test.

This won't impose an impossible burden on refiners, however. Air Force has found that jet fuel supplied by 92% of present suppliers already meets its proposed test. Others can meet the test by using additives, by sulfuric-acid treatment, or by hydrotreating.

Exotic fuels have been getting the headlines. But the

present hydrocarbon fuels will supply bulk of military requirements for some time to come.

Military Petroleum Supply Agency sees demand for special fuels of high-performance weapons systems hitting 2,500,000 bbl. per year against current JP-4 needs of almost 100,000,000 bbl. per year.

JP-4 is, and for some time will be, the big jet fuel need of the armed forces. However, JP-6, a wide-cut kerosine, is coming along and in time may supplant JP-4. The JP-6 is designed for use in land-based supersonic aircraft. As more such craft become operational, demand for JP-6 will go up proportionately.

IPAA has revised its predictions on 1958 business.

New indications for the year show:

...Domestic demand up 1.5% over 1957, averaging 8,948,000 bbl. daily. This compares with average annual increase in demand of 4%.

...Total demand off 1.8% caused by a 50% drop in exports.

New projection of domestic demand is 270,000 bbl. daily under earlier guess. This drop is due to lowered estimates for gasoline and residual.

Costs still are going up, another IPAA study committee finds. For example:

...Finding oil last year required 99 ft. of hole for each 1,000 bbl. of crude found. It was 85 ft. a year earlier.

...Development of 1,000 bbl. of new reserves required 86 ft. of drilling. It averaged 61 in 1952-56. At same time unit costs of material, equipment, and labor have risen.

...Lifting costs are still on the rise. Payrolls, which are biggest single item in these costs, took a 10% jump in 1957 over 1956.

First quarter 1958 profits are showing the effects of production and refinery cutbacks. Latest reports: Atlantic Refining, down to $2.6 million from $14.7 for same quarter last year...Continental, down to $10.6 from $13.6 million... Imperial, down to $15 from $21.5 million...Phillips, down to $20.5 from $28.3 million...Standard of California, down to $57.4 from $69.4 million...Jersey Standard, down to $167 from $237 million...Standard of Ohio, down to $4.3 from $7.8 million...Shell, down to $26.4 from $41.4 million...Sun, down to $3.5 from $13.3 million...Royalite, down to $669,828 from $761,178...Ohio Oil, down to $8.3 from $12.6 million... Signal, down to $2.9 from $3.1 million...Skelly, down to $6 from $11.3 million...Socony Mobil, down to $39.1 from $67.7 million...Union Oil, down to $5.9 from $9.3 million...Sinclair Venezuelan, up to $5.3 from $2.2 million...Texas Eastern Transmission, up $26.4 from $17.8 million...U. S. Steel, down to $62.4 from $115.5 million.

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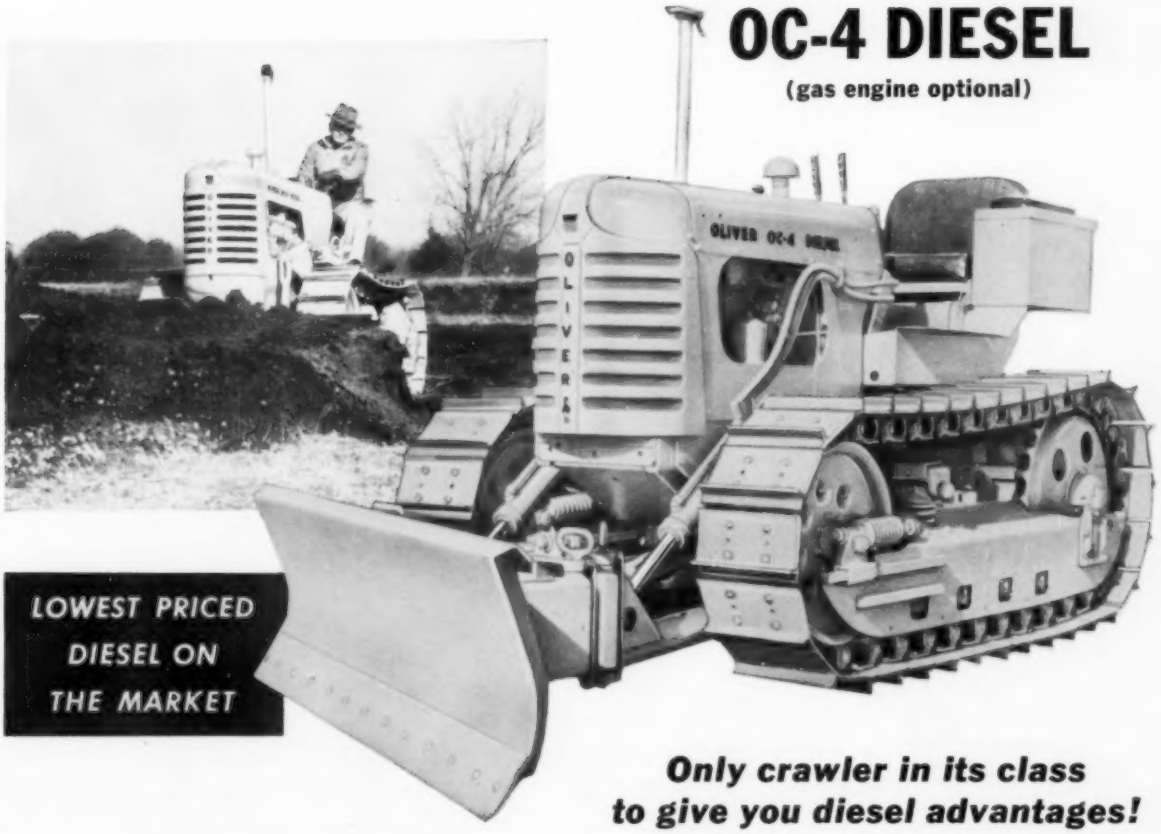

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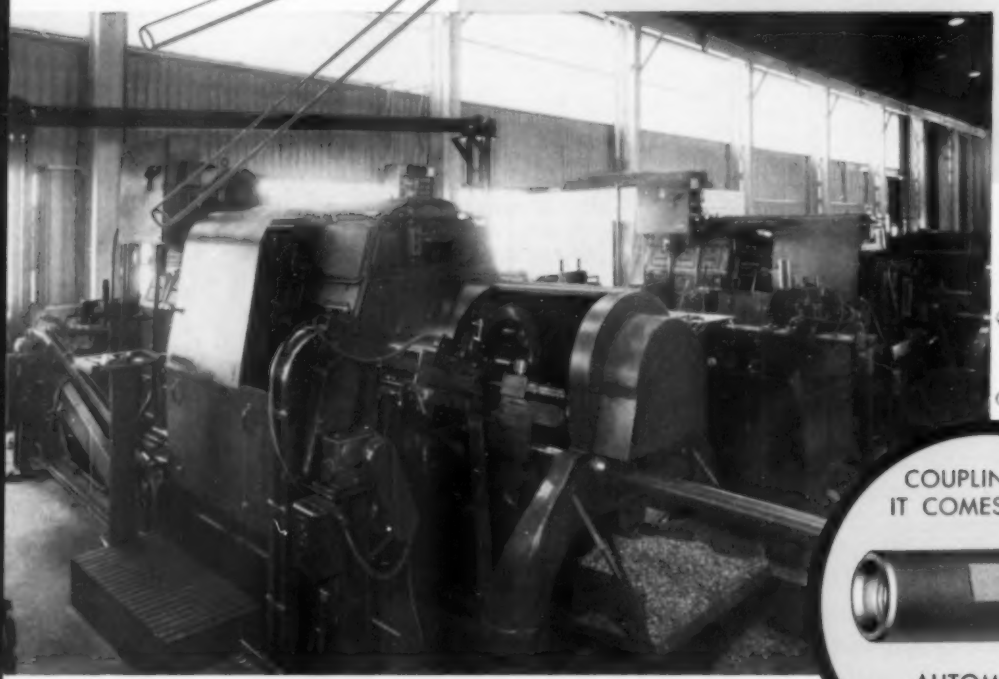
MECHANICAL MARVEL

makes Sucker Rod Couplings on Push-button Orders



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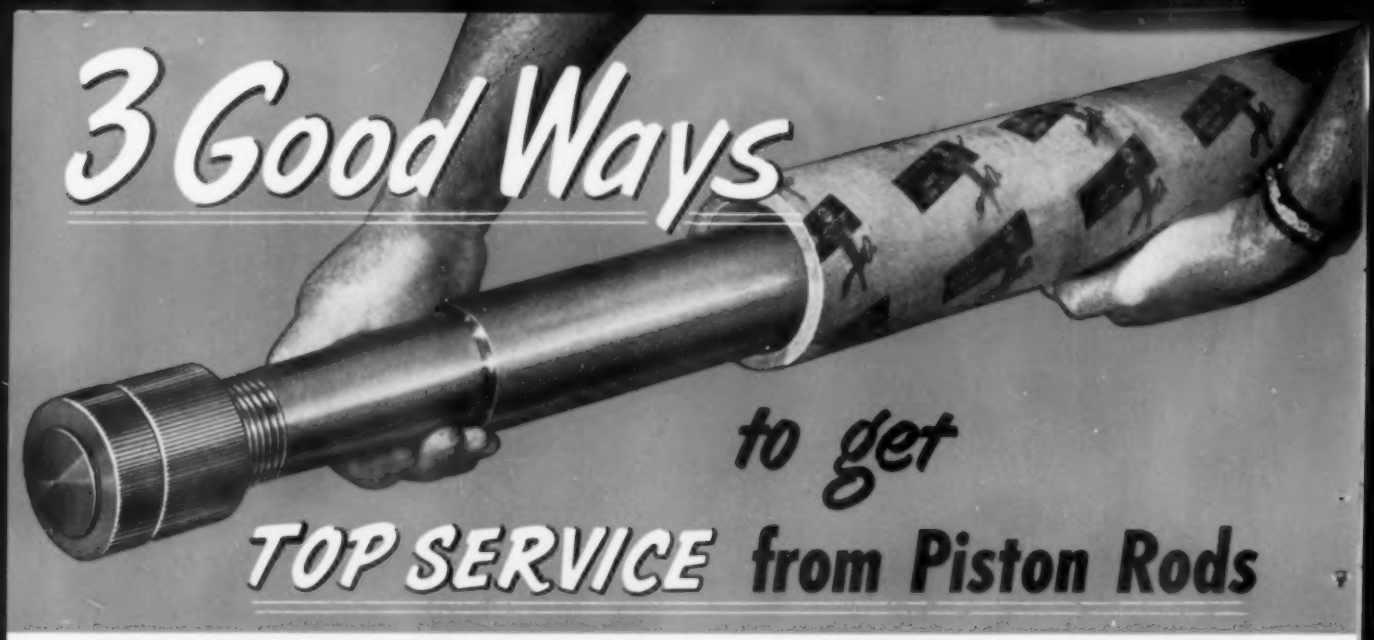

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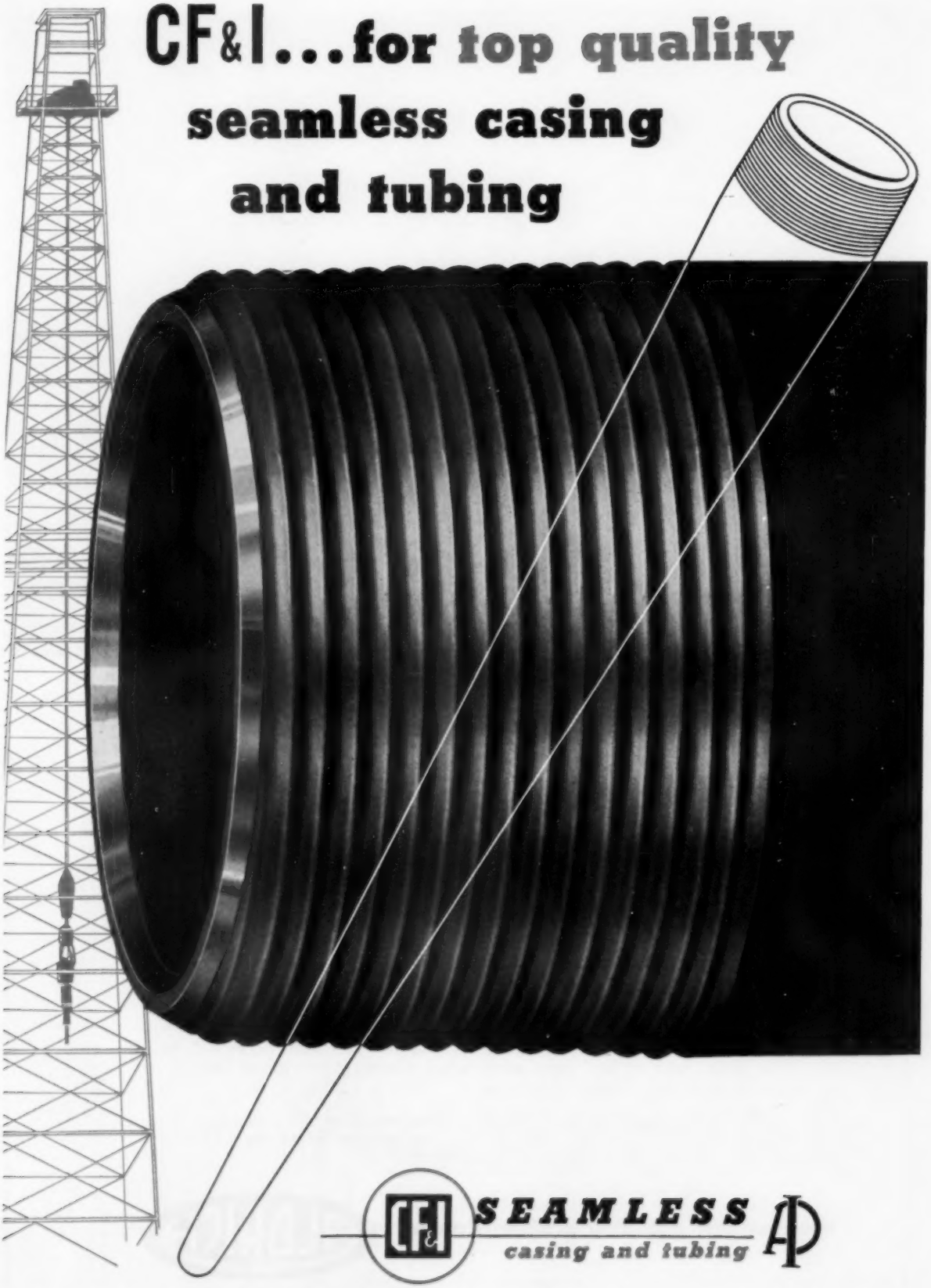

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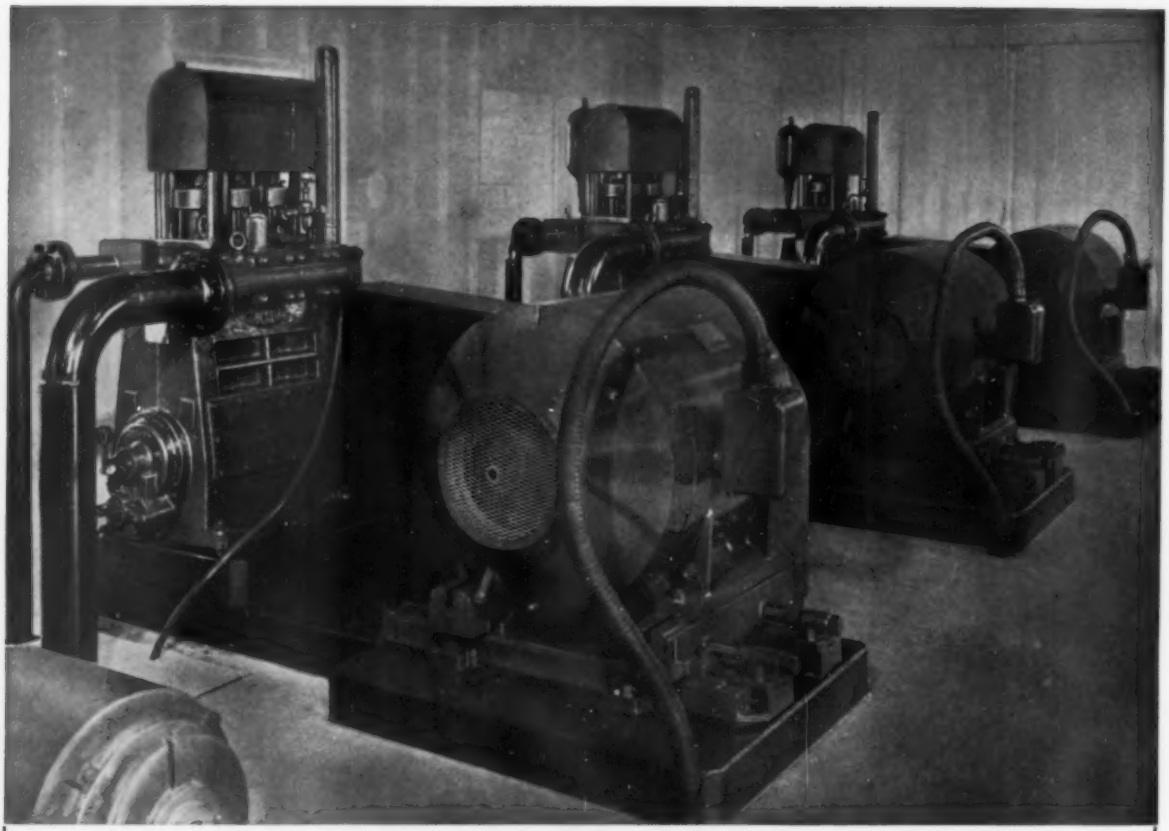

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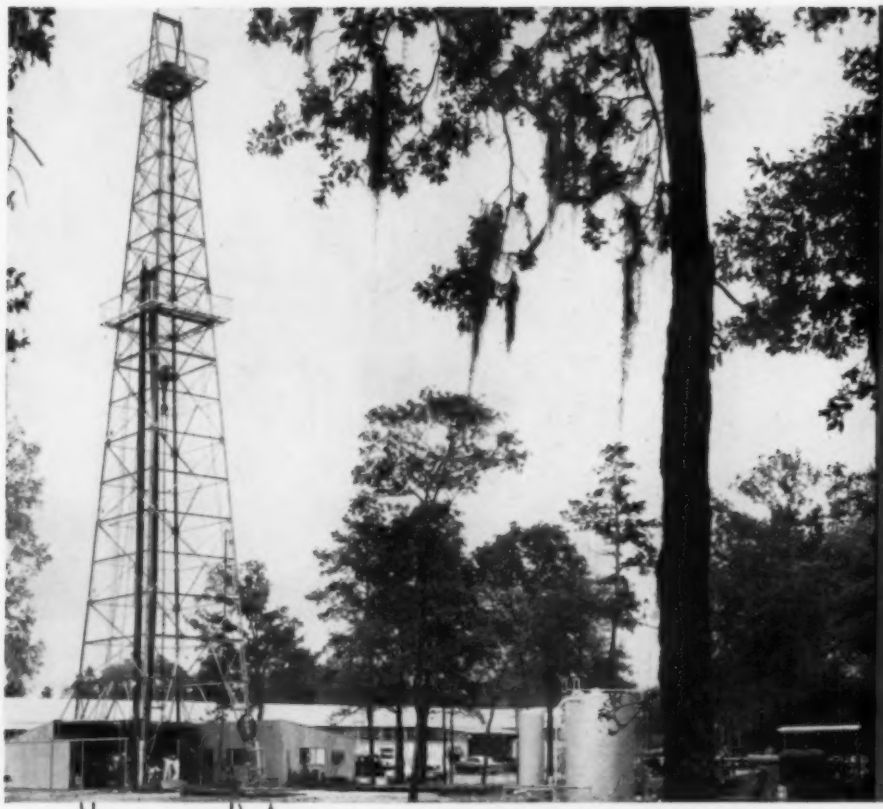
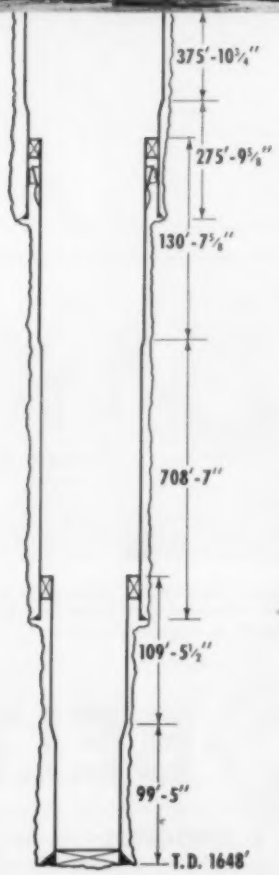


Here's The Proving Ground!



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Almost daily, production men and engineers visit Brown Oil Tools seeking answers to special production problems, to view the operation of new tools, to study special tool applications, or to learn about new production methods and equipment.

What attracts these men from all parts of the United States, Canada, Mexico, Europe, South America, Africa, and both the Near and Far East? It all started with the pioneering of parallel string equipment and now, with the completion of their test well, Brown offers a proving ground for each piece of their down-hole equipment.

The value of the test well in research and equipment development can be attested to by all who have witnessed the operations conducted here.

Actual or expected well conditions can be duplicated for the proving of tools or hook-ups. Operators can learn what will work before they complete their well. Problems are solved here and not at the operators' well.

All Brown tools are thoroughly tested under tough, realistic conditions. Your guarantee that Brown equipment is dependable.

Constantly, experiments are conducted on new tools and applications. Your assurance that Brown will have the answers and the tools for future production problems.

For tested and proven production and fishing tools, call your nearest Brown representative.

BROWN
OIL TOOLS, INC.

8490 Katy Road, Houston, Texas

Export Offices: Acme Well Supply, New York City. Import Tool Co., Edmonton and Calgary, Alberta, Canada. A-Z Export, S.A., Maracaibo and Puerto La Cruz, Venezuela. Miguel Rocca, Mexico City.

FR

Fatigue Resistant

LINK-BELT's answer to endurance demands on roller chain

THIS IS FR. * By compressing the metal around pitch holes, Link-Belt greatly strengthens the critical sidebar areas most vulnerable to fatigue failure. This original development is the result of Link-Belt roller chain research and unequalled depth of oil field experience. FR is standard on Link-Belt oil field roller chain.

* U.S. Patent No. 2,517,497

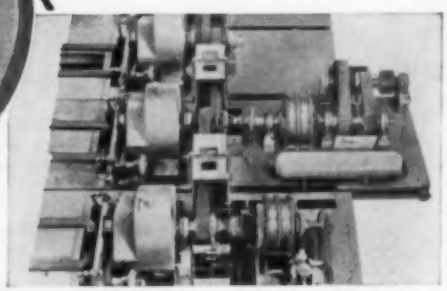
Greater sidebar Fatigue Resistance means greater dynamic strength... increased chain endurance

Today's high drilling speeds, great hook loads and heavy drill collar strings continually create a brute punishment no ordinary roller chain can long withstand. That's why modern rigs need Link-Belt roller chain with its vastly superior *dynamic strength* produced by the FR process.

This is just one of many "extras" you get in Link-Belt oil field roller chain. Others include:

- SHOT-PEENED ROLLERS with extra fatigue life.
- PRE-STRESSING for load bearing uniformity.
- E-Z ASSEMBLY to facilitate field installation.
- SHEPHERD'S CROOK COTTERS that won't shake loose.
- DOUBLE BOXING—most effective in the field.

For full information on them all, ask any leading supply store for your copy of Link-Belt Catalog 2780.

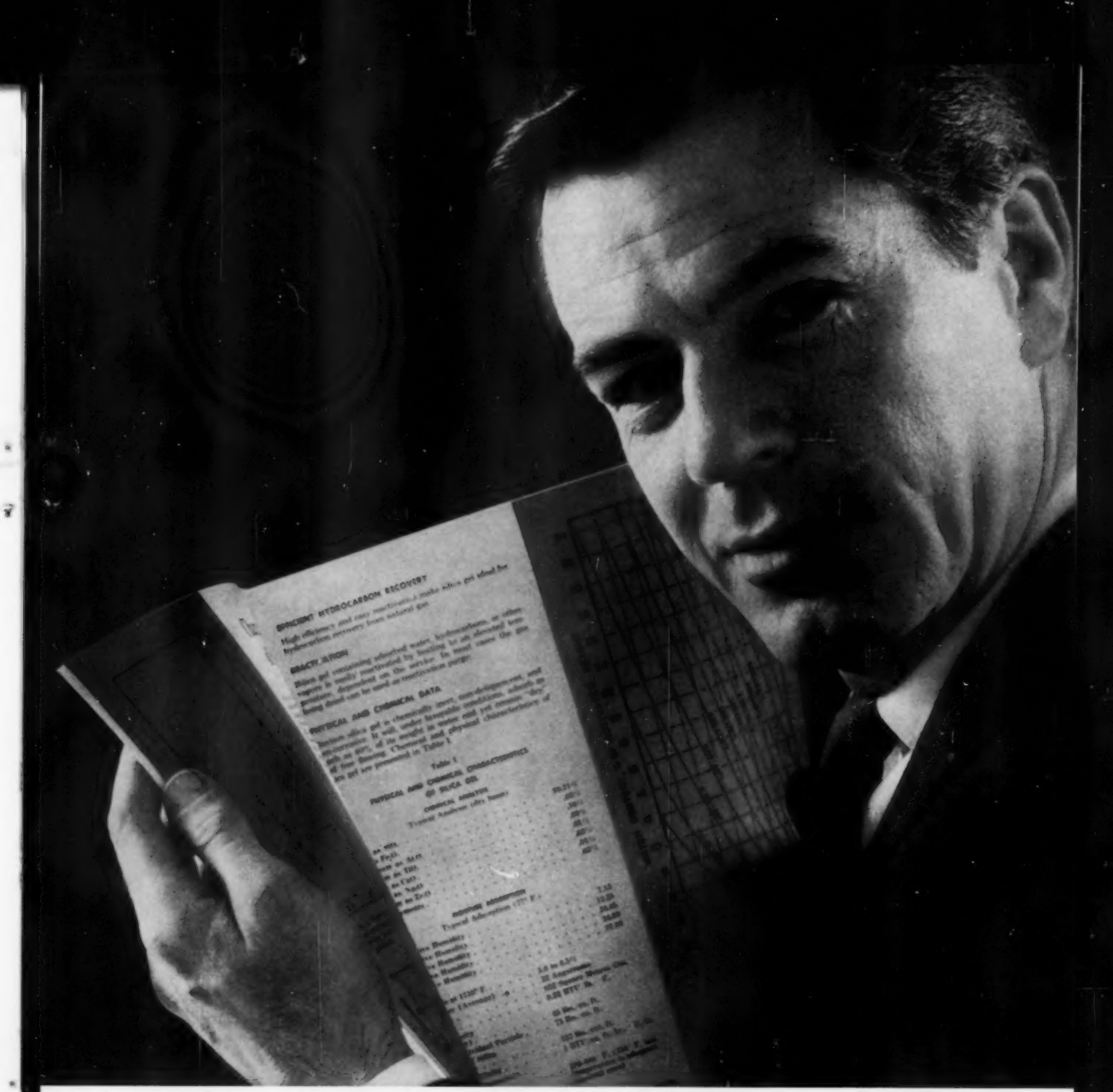


NATIONAL SUPPLY FOUR SECTION DRIVE GROUP, TYPE B-18G, incorporates Link-Belt FR roller chain—supplied as original equipment.

LINK-BELT

ROLLER CHAINS & SPROCKETS

LINK-BELT COMPANY: Indianapolis 6, Houston 1, Dallas 26, Odessa, Tex., New Orleans 16, Shreveport, La., Los Angeles 22 (Montebello), Scarboro (Toronto 13); Export Office, New York 7. Distributors in All Fields. 14,017



New from Davison . . . Technical Bulletin 202 on adsorption and dehydration with silica gel

If you have anything at all to do with air and gas dehydration, you'll want this 20-page, well-illustrated technical bulletin.

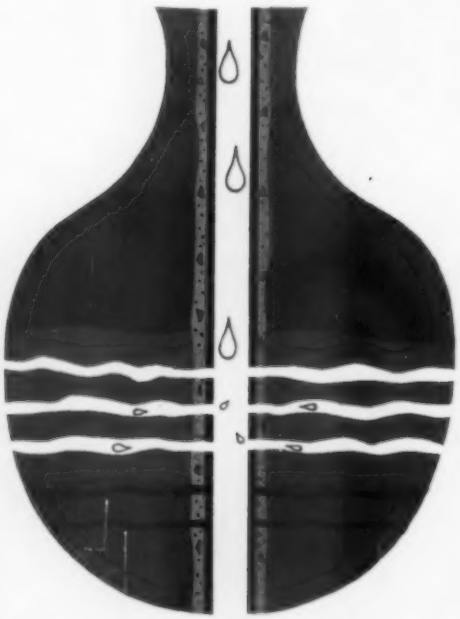
Here, in text and graph form, is a wealth of valuable, up-to-date technical data on: characteristics of silica gel; fundamentals of adsorption and dehydration; natural gas dehydration; recovery of hydrocarbons from natural gas; compressed air dehydration; atmospheric dehumidification; dehydration of industrial gases; special types of silica gel; and other applications of silica gel. The data presented are based on reliable laboratory and field tests.

We're sure you'll find Technical Bulletin 202 of great assistance in your everyday work. To receive a copy, write to us on company letterhead.

DAVISON
CHEMICAL COMPANY
Division of W. R. Grace & Co.
Baltimore 3, Maryland

NEW LIFE FOR YOUR WELL...

HALLIBURTON'S UNMATCHED ACIDIZING EXPERIENCE



If oil or gas is there, a Halliburton Acidizing Service will help you to maximum recovery.

In thousands of wells, Halliburton Acidizing Services have started new production and revived old production, by improving permeability, removing mud cake and breaking water and emulsion blocks.

Halliburton puts the industry's most effective chemical weapons against production barriers to work in your well, augmented by specifically designed, highly efficient tools. Experienced and trained field personnel, familiar with formation problems, skillfully apply these tools and chemicals for maximum recovery results.

Get all the benefits that only modern chemistry and physics can give to your well. Specify Halliburton... the world's most experienced service organization... for *your* acidizing needs!

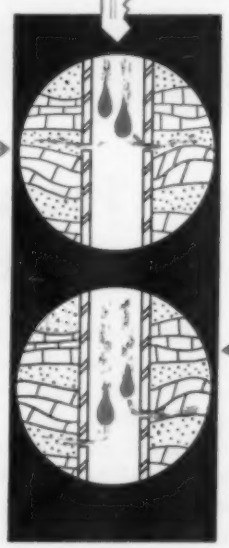
HALLIBURTON CHEMICALS AND TOOLS...

KEYS TO HELP OPEN LOCKED DEPOSITS OF OIL

HYDROCHLORIC ACID

Hydrochloric Acid is most effectively used in the treatment of limestone and dolomite formations to improve permeability. The reaction products are soluble, permitting the removal of the dissolved limestone or dolomite in the spent acid solution. Specific non-emulsifying agents are mixed with the acid, when necessary, to prevent the formation of viscous emulsions.

Hydrochloric Acid is also used as the base fluid of Halliburton Acidfrac and in conjunction with other fracturing services.



HALLIBURTON'S "HV" ACID

Halliburton's "HV" (High Viscosity) Acid inherently delays reaction until the solution is at a greater distance from the well bore, with a resulting larger well drainage area. A comparable volume of Halliburton's "HV" Acid may cover from 4 to 9 times the drainage area of ordinary acid. Extremely useful for temporarily plugging highly permeable sections of well bore in old wells or those previously acidized... which diverts following non-emulsifying acid to other zones... thus opening up new drainage channels.

Acid Formation Cleaner

HALLIBURTON'S ACID FORMATION CLEANER

Use Halliburton's Acid Formation Cleaner to wash potentially productive zones with fast-acting acid before testing, to minimize hole damage caused during the drilling process. Especially valuable in areas where zones of very low formation pressure can be blocked by mud filter cake alone.

HALLIBURTON'S MCA (Mud Cleanout Agent)

Through the use of Halliburton's MCA, natural oil or gas flow channels may be re-opened, and on cement jobs, cement is more firmly bonded to formations. If normal permeability has been plugged by mud cake or if mud is lost in the formation crevices and flow channels, an exclusive chemical constituent in MCA aids in softening and dispersing the mud for easier removal.

"HM" Packer

HALLIBURTON'S "HM" PACKER

This versatile, rugged packer can be set again and again for treating different horizons at any point in the well... Proper segregation of the zone to be treated is efficiently accomplished. The "HM" (Hydro-Mechanical) Packer is just one of a wide range of Halliburton packers, research-developed to combine dependable performance, easy operation and time-saving versatility.

HALLIBURTON'S "Fe" ACID

Primarily designed to prevent abnormal amounts of dissolved iron from precipitating after the hydrochloric acid is spent. Holds iron in solution, prohibits formation of a reddish-brown sludge which can act as a plugging agent in permeable channels.

"Fe" Acid is more applicable to treatments in water flooding or disposal wells... used to remove accumulated iron from the water or after acid reaction with rusty pipe, and then deposited at or near the well bore as hydroxides or oxide mixtures... where it reduces the input of water at previous pressures.

HALLIBURTON CHEMICAL SERVICES

HALLIBURTON OIL WELL CEMENTING COMPANY, DUNCAN, OKLAHOMA

NEW LIFE FOR YOUR WELL...WITH ACIDIZING

The most dependable
PIPELINE PROTECTION
for only ½ of 1%
of the original Pipeline Cost

L·O·F Glass Fibers'

BLUE FLAG®

reinforcing pipe wrap

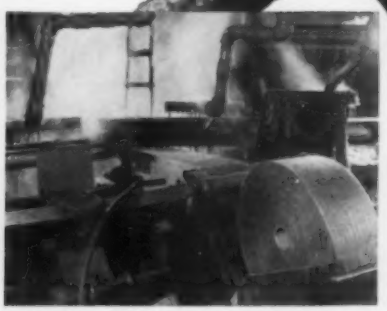
The low-cost preservation of huge pipeline investments has been conclusively demonstrated by the performance of L·O·F Glass Fibers' Blue Flag in thousands of miles of pipeline construction.

Subjected to punishing tests in extremely corrosive environments, Blue Flag has proved time and time again that it adds years of service beyond normal pipeline life.

Made of special inert glass, which resists the corrosive action of soil, Blue Flag is a strong uniformly porous mat that increases enamel strength, reduces "holidays" . . . provides high resistance to cracking and backfill damage.

EVERY DAY MORE AND MORE CORROSION ENGINEERS AND PIPELINE EXECUTIVES ARE SPECIFYING "BLUE FLAG" UNDERGROUND PIPE WRAP.

High tensile strength of Blue Flag virtually eliminates breakage during field wrapping operations.



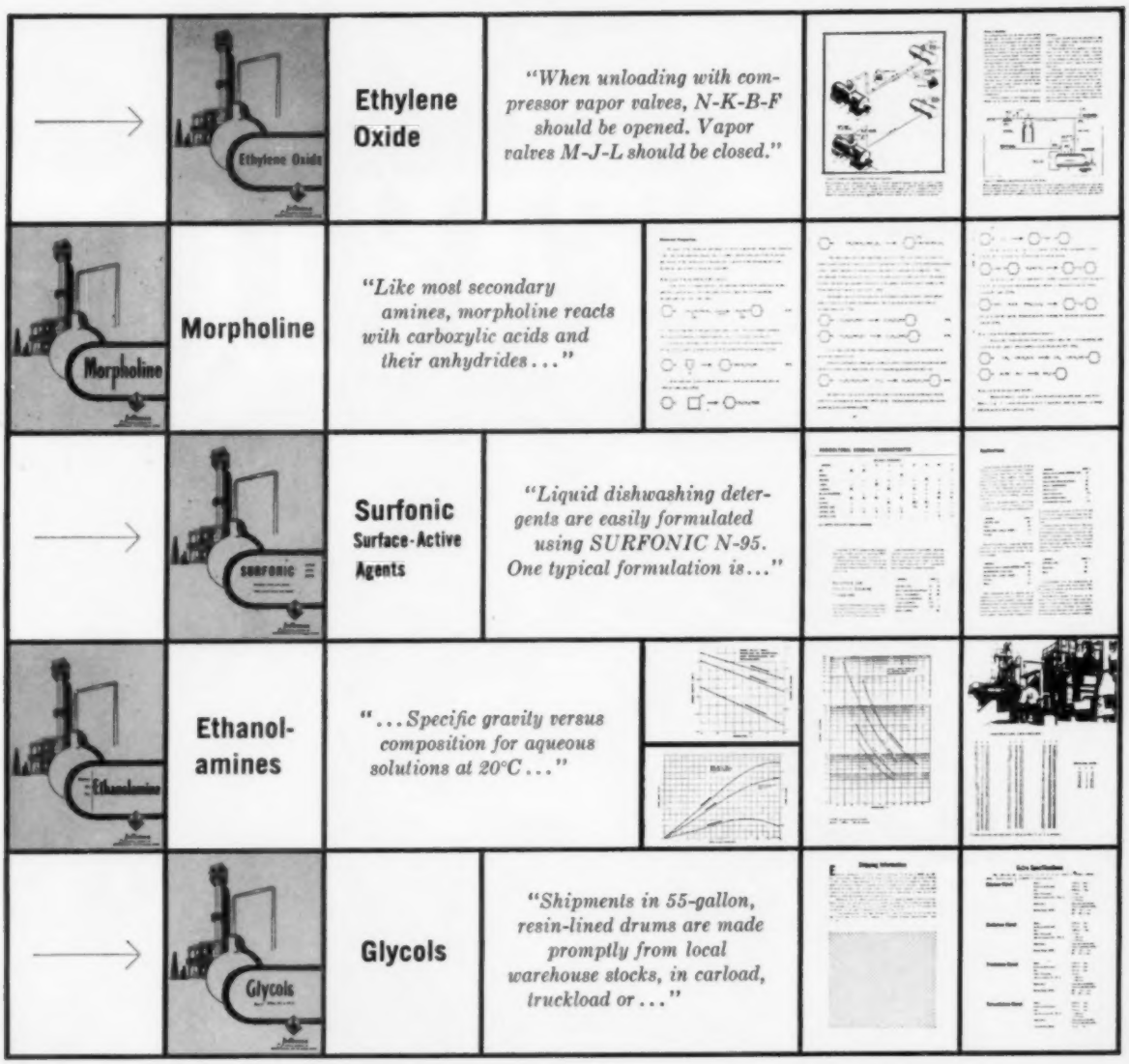
Specify Blue Flag on mill wrapped pipe for added resistance to corrosion.

You get extra protection from backfill damage with Duramat® glass fiber reinforced outer wrap.

L·O·F GLASS FIBERS

For full details on complete pipeline protection, write to:
L·O·F Glass Fibers Company, Dept. 78-58, 1810 Madison Avenue, Toledo 1, Ohio

L·O·F GLASS FIBERS COMPANY
TOLEDO 1, OHIO


Ethylene Oxide
Ethylene Oxide
"When unloading with compressor vapor valves, N-K-B-F should be opened. Vapor valves M-J-L should be closed."
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"Like most secondary amines, morpholine reacts with carboxylic acids and their anhydrides..."
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Excerpts from Jefferson technical literature

The information you want—on reactions, formulation, properties, handling and service... you'll find in

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Essential Chemicals from Hydrocarbon Sources

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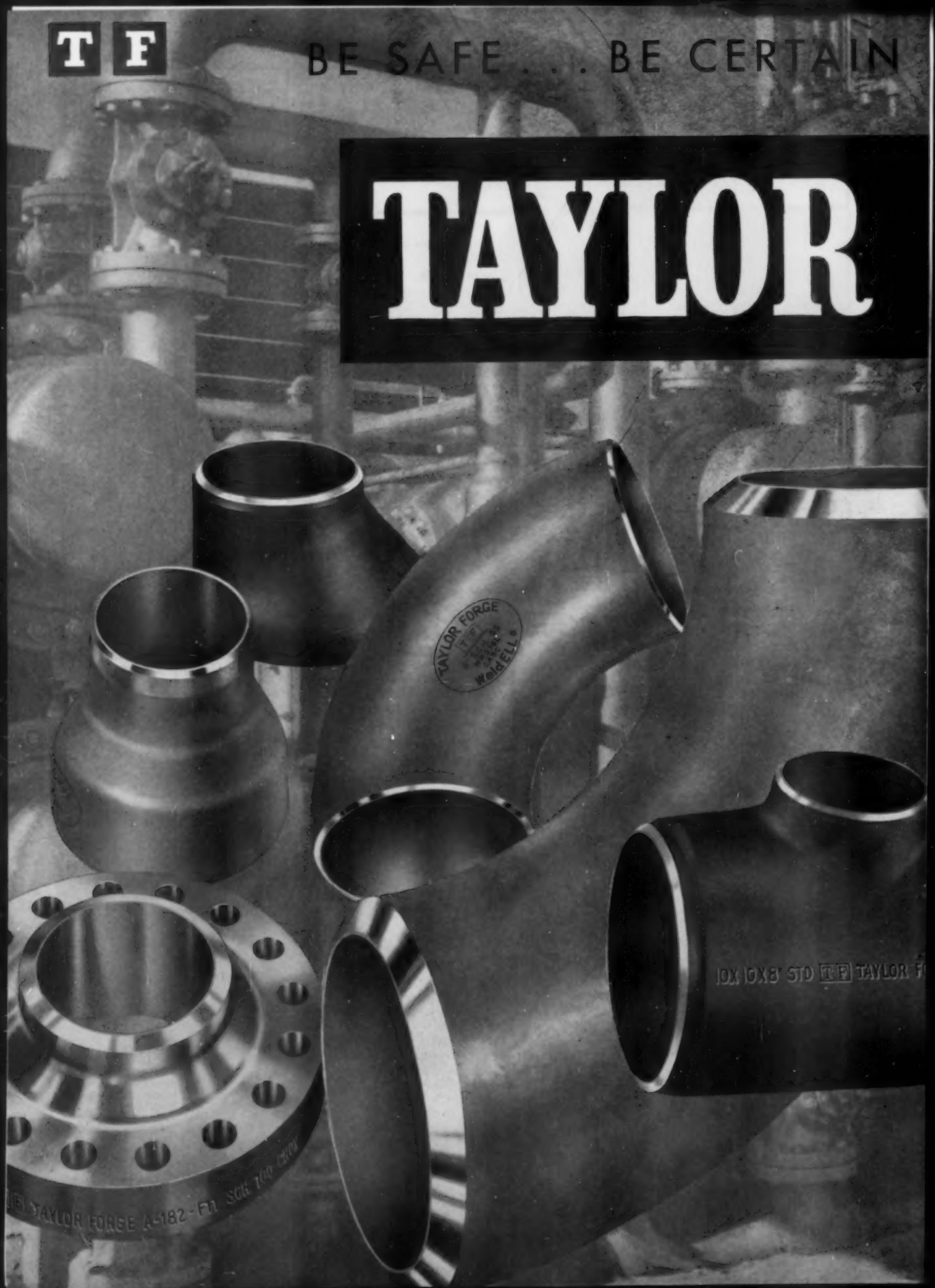
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Whether it's a *Carbon Steel* Tee for some ordinary service or an *Alloy Steel* Flange for a high pressure-temperature application . . . whether it's a light wall Stainless Steel WeldELL for corrosion resistance or an extremely heavy one for the most critical nuclear power plant . . . whatever it is you can be safe . . . certain . . . confident . . . if it's made by Taylor Forge. For that name and this marking [T] [F] appear only on products for piping and pressure vessel construction that are truly

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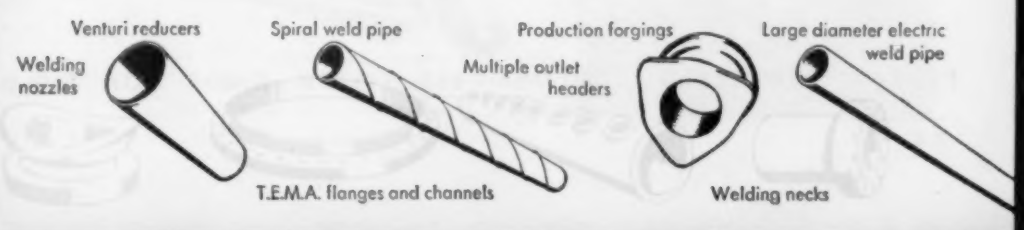
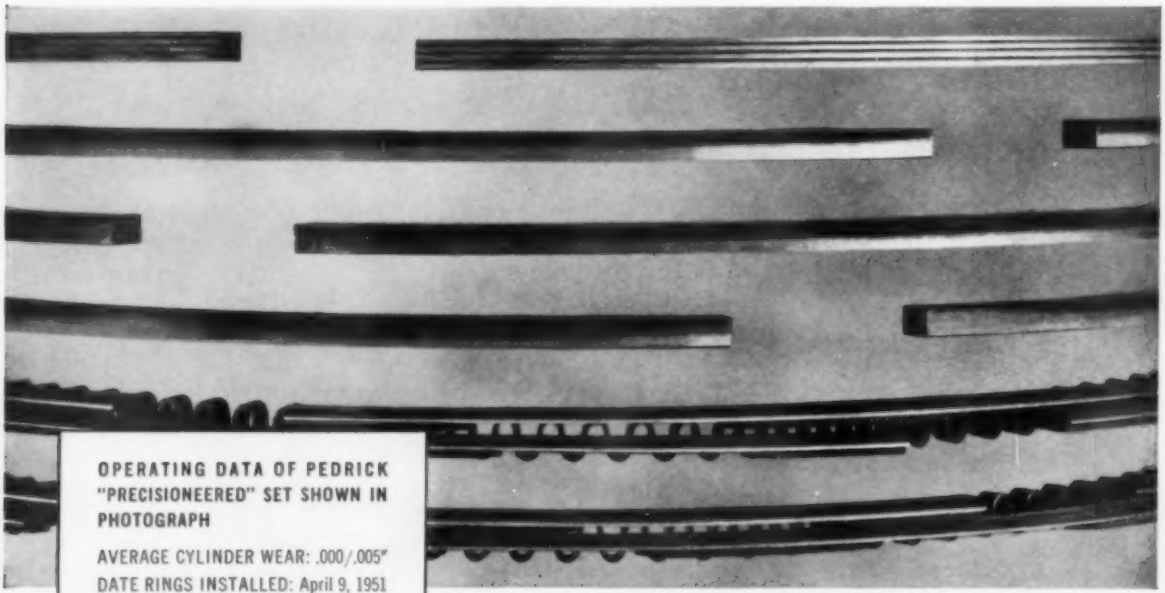
Call your Taylor Forge Distributor *For prompt, efficient service on the complete Taylor Forge line of Welding Fittings and Forged Flanges, patronize your local Taylor Forge Distributor.*



40,622 hours of operation

. . . an average of 6,350 h.p. hrs. per gal. total lube oil consumption.

The photograph shows Pedrick Piston Rings removed from a Cooper-Bessemer GMVTF 10 cylinder engine after 40,622 hours of operation. Note carefully how the face-wear on the rings (the bright area) extends only half way up. After more than six years of *full load* service, these Pedrick rings are practically as good as new.



OPERATING DATA OF PEDRICK "PRECISIONEERED" SET SHOWN IN PHOTOGRAPH

AVERAGE CYLINDER WEAR: .000/.005"
DATE RINGS INSTALLED: April 9, 1951
DATE RINGS REMOVED: June 27, 1957
TYPE LUBE OIL: DTE No. 3 MAGNOLIA
RATED HORSEPOWER: 1100
MAXIMUM OVERLOAD: 10%
LUBE OIL CONSUMPTION: CRANKCASE—39,600 H.P. Hours per Gal. LUBRICATORS—(14 qts. per day) 7,530 H.P. Hours per Gal.
TOTAL LUBE OIL CONSUMPTION (CRANKCASE AND LUBRICATORS): 6,350 H.P. Hours per Gal.

For longer life at full power, make Pedrick "Precisioneered" Piston Ring Sets your *standard* replacement sets. You'll find your Pedrick engineer will be glad to call and help you solve any special problems. Write, wire or phone:
WILKENING MANUFACTURING CO., Phila. 42, Pa.
In Canada: Toronto 2.

Pedrick PISTON RINGS

PEDRICK PIONEERED CONFORMABLE PISTON RINGS FOR BIG-BORE ENGINES

Engineering Progress Report

FROM UNION CARBIDE CHEMICALS COMPANY

Glycol Dehydrators give 90°F. Dew Point Depressions...

Improved regeneration systems give high glycol concentrations

There are two methods commonly used today to dehydrate natural gas: one employs glycols; the other, dry desiccants. Most authorities agree that glycol systems are less expensive in both initial and operating costs. Recent engineering advances now permit dew point depressions up to 90°F. with economical glycol-type dehydrators. Union Carbide Chemicals Company maintains an extensive engineering service group designed to help the natural gas industry obtain the best possible dehydration service with CARBIDE'S diethylene glycol and triethylene glycol.

A GRADUAL IMPROVEMENT

Diethylene glycol was first used to dehydrate natural gas in 1936 and by 1939 sixteen glycol type plants were in service providing average dew point depressions in the range of 40°F. Triethylene glycol was first used to dehydrate natural gas in 1949. The dew point depressions realized with glycol type plants have gradually increased until today the standard guarantee is a 65°F. depression or gas containing seven pounds of water per MMSCF, whichever first occurs. For sometime now, some equipment manufacturers have offered a 75°F. dew point depression guarantee.

FACTORS INFLUENCING DEW POINT DEPRESSION

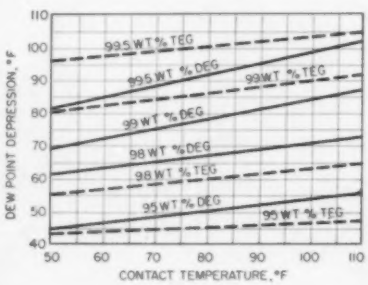
The dew-point depression obtained with a glycol dehydration plant depends upon several factors, such as:

1. Concentration of water in the lean glycol solution.
2. Glycol circulation rate.
3. Contact temperature in the top of the absorber column.
4. Efficiency of gas to glycol contact in the absorber.

Even with conservative design and operation, however, the dew point of the gas leaving the glycol contactor cannot be lower than the equilibrium value for the conditions of temperature and glycol concentration found on the top plate.

HIGH GLYCOL CONCENTRATIONS

The high diethylene and triethylene glycol concentrations now being obtained in plant practice, prompted studies to determine the dew point depressions obtainable with such solutions.



These data indicate that both diethylene and triethylene glycol at 99.5 per cent concentrations provide dew-point depressions in the 80°-105°F. range.

At concentrations of 98 per cent and lower, diethylene glycol provides better depressions than equal concentrations of triethylene glycol, while at 99 and 99.5 per cent concentrations, triethylene glycol appears to allow a 5°-10°F. lower dew point than diethylene glycol.

90°F. DEPRESSION MEETS TRANSMISSION REQUIREMENTS

Glycol regeneration equipment on the market today is capable of producing and maintaining glycol concentrations above 99%. Thus, it is possible for equipment manufacturers to guarantee a 90°F. minimum dew point depression. There are very few instances where a 90°F. depression will not meet the water content specifications of any long distance gas transmission company.

CARBIDE'S RESEARCH PROGRAM

Dew point depression studies are but one phase of CARBIDE'S extensive research activities designed to improve the products and processes of the natural gas treating industry. CARBIDE'S Technical Service Department stands ready to help you obtain the best possible results from your gas treating installations. For more information on the use of CARBIDE'S glycols for gas dehydration, call the nearest CARBIDE technical representative or write, Union Carbide Chemicals Company, Department B, 30 East 42nd Street, New York 17, N. Y.

"Union Carbide" is a registered trade-mark of Union Carbide Corporation

UNION CARBIDE
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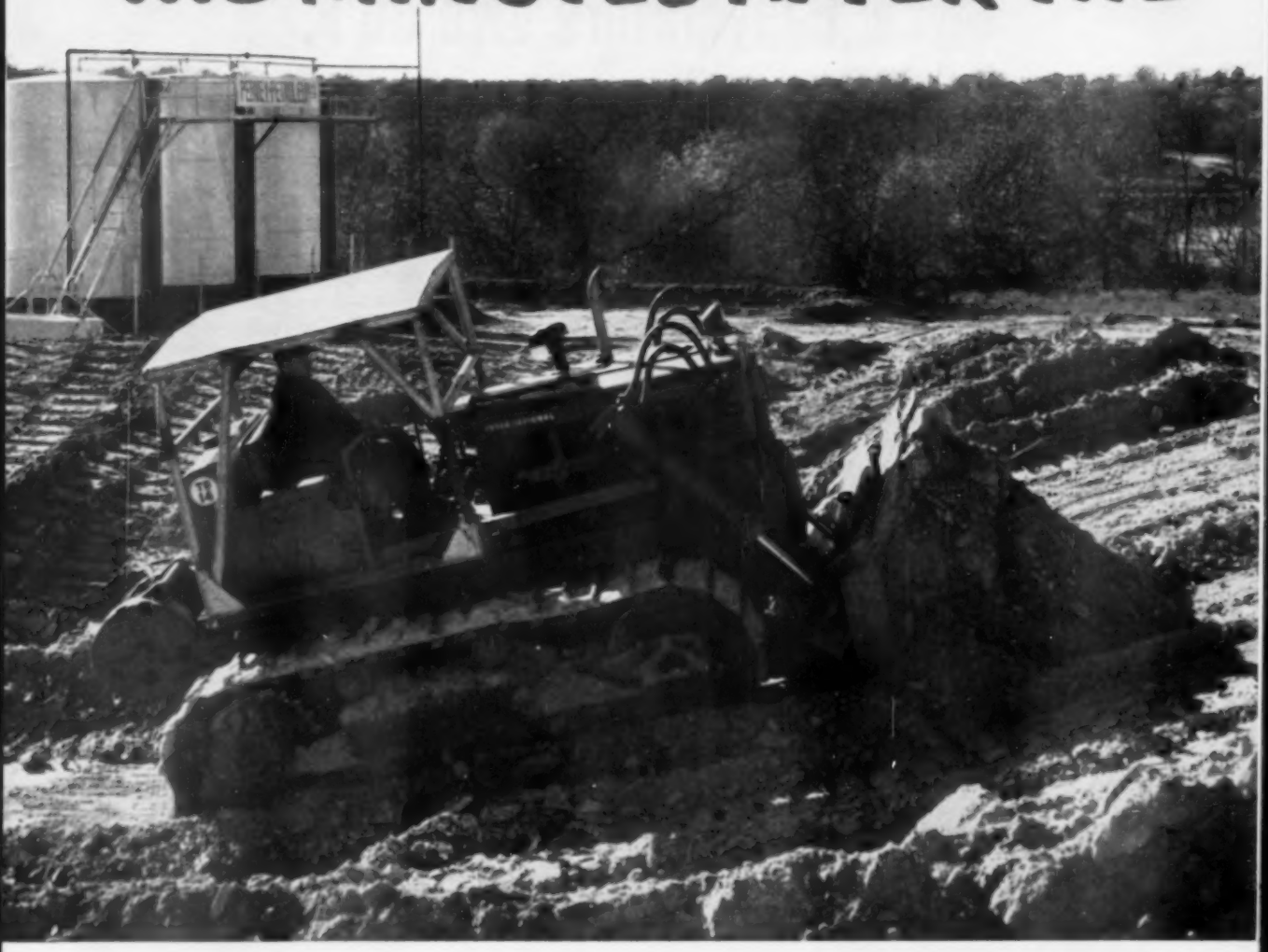
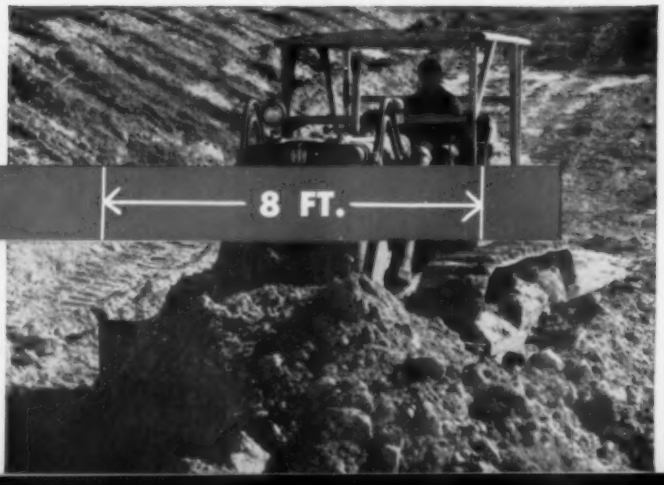
TD-14's with inside

...5 MINUTES AFTER THE





Only eight feet wide—so the TD-14 with inside mounted 'dozer makes an ideal outfit for hard digging because the narrower-than-standard blade concentrates dozing hp. The 8-foot blade is the same width as a standard lowboy trailer, allowing fast transport over highways, day or night, without permits!

dozers "move out"

PIT IS DUG!

—for Sullivan & French, Fox, Okla.

Sullivan & French, Fox, Oklahoma, own three TD-14's for contract work in the nearby oil fields. This TD-14 is carving a salt water pit in hard clay. Full-floating TD-14 track-roller seals exclude grit, retain lubricant so efficiently that the lubrication interval is extended up to 500 hours!

Concentrate the International TD-14's full push through the inside-mounted 8-foot-wide dozer blade—and you get tremendous digging and earth-rolling action!

The outfit shown is one of three TD-14's owned by Sullivan and French, Fox, Oklahoma. Even in hard, dry clay this rig gouges out a salt water pit in short order.

And five minutes later, the easily transportable TD-14 can be highballing to the next job. The operator simply drives it on a lowboy—chains it down—and heads for more pay-dirt!

Seconds-fast International gasoline-conversion starting readies the TD-14's diesel engine for full-load performance. Clean deck design, control tower visibility, and full-time Hydraulic booster steering provide vital operating ease and safety for rough-and-tumble oil field work.

No wonder a TD-14 equipped with inside-mounted dozer can do in one day several oil field jobs that are miles apart!

Prove TD-14 capacity and all-around operating economy on tough roadbuilding, drill-site preparation, pond building or other oil field work. Then profit by its fast mobility and job-hopping speed with an inside mounted dozer. See your International Construction Equipment Distributor for a demonstration!

International® Construction Equipment

International Harvester Co., 180 N. Michigan Avenue, Chicago 1, Illinois

A COMPLETE POWER PACKAGE: Crawler and Wheel Tractors . . . Self-Propelled Scrapers . . . Crawler and Rubber-Tired Loaders . . . Off-Highway Haulers . . . Diesel and Carbureted Engines . . . Motor Trucks . . . Farm Tractors and Equipment.

More light on producing hydrogen economically ...Tidewater uses heat-resistant Incoloy tubing

The hydrogen plant at Tidewater Oil Company's new Delaware Refinery is the first such unit ever built to supply a refinery's desulfurizer. Capacity is 30 million cubic feet of hydrogen per day.

High temperature-pressure problem

Metal temperatures in the reformer furnaces are in excess of 1700° F with internal pressures of the reacting gases sufficiently high to emphasize the need for strength and ductility. To provide these properties, the tubes in one furnace are made of extruded Incoloy* nickel-iron-chromium alloy.

Incoloy is the solution

Incoloy alloy exhibits high creep strength and rupture strength combined with satisfactory ductility. It is not susceptible to embrittlement resulting from structural changes after prolonged heating. Of special importance in containing hydrogen under pressure is the ability of the alloy to provide welds of high integrity. Furthermore, when used in the extruded form, the alloy offers decided economies over other materials.

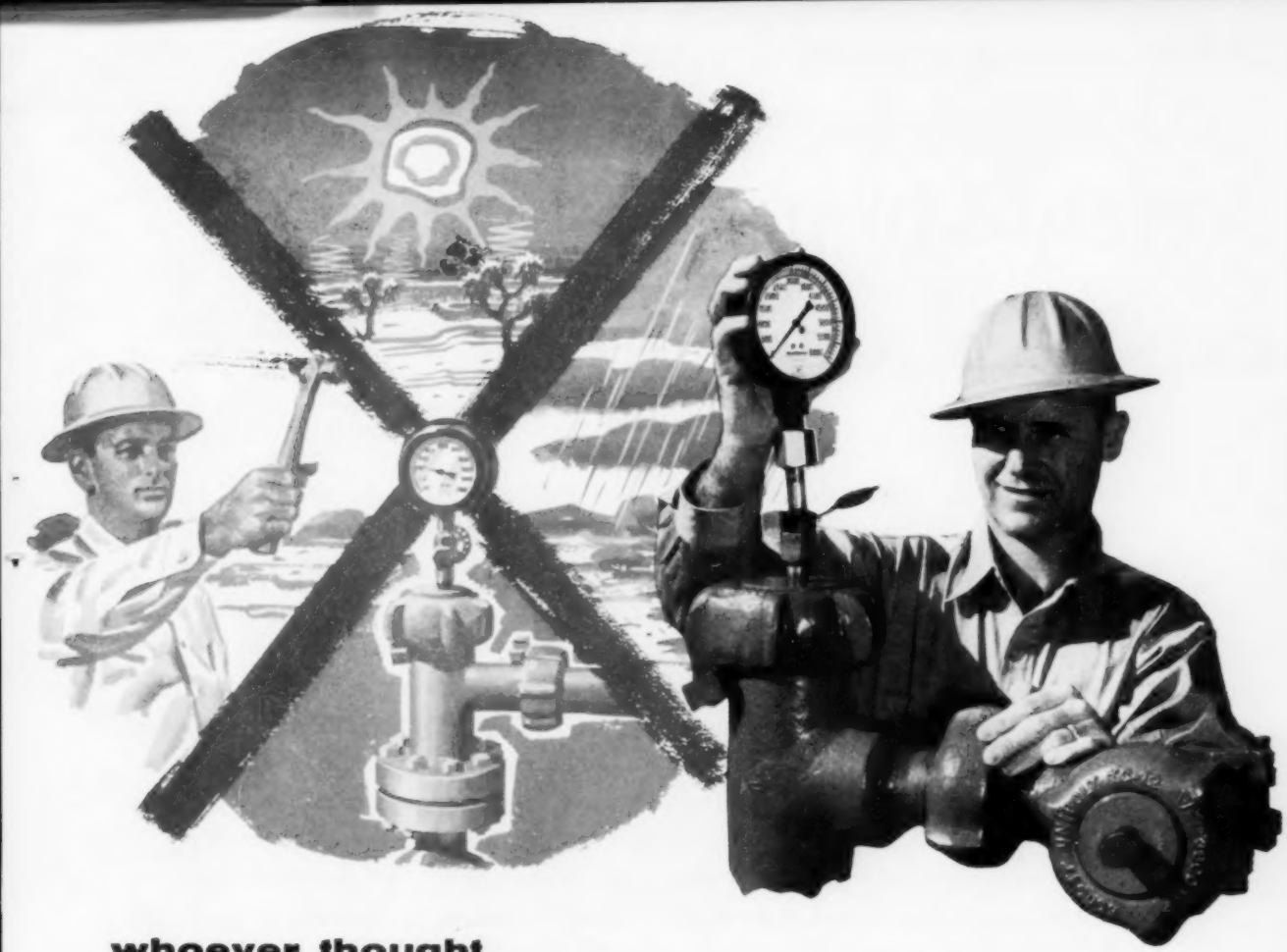
Incoloy alloy is also used here in the reformer heater outlet manifold and reformer outlet to desuperheater.

For more information, or for help with a high temperature or corrosion engineering problem of your own, write Inco's Development and Research Division.

*Registered trademark

The International Nickel Company, Inc.
67 Wall Street New York 5, N. Y.

INCO NICKEL ALLOYS



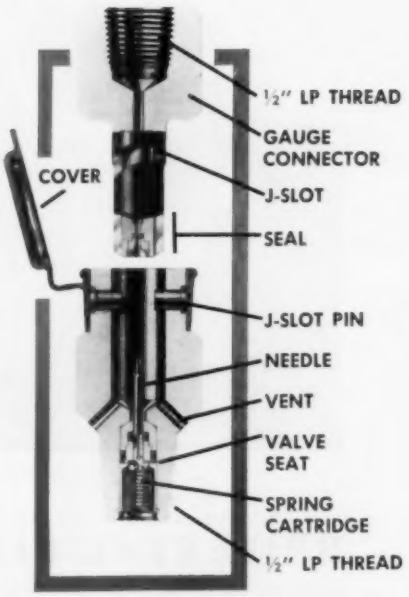
whoever thought there would be a better way to gauge well pressures!

Permanently installed Christmas tree gauges are an unnecessary capital investment and maintenance expense. Furthermore, they are subject to vandalism and accidental breakage. Constant exposure to the elements can affect gauge accuracy, resulting in incorrect pressure readings.

There's a new and better way to gauge well pressures. The TC Gauge Valve and Connector permits the operator to gauge dozens of wells with a single pressure gauge. Only the Gauge Valve element is installed permanently on the tree, and a single master gauge is carried from well to well to obtain the pressure readings.

Note in the cutaway view of the TC Gauge Valve and Connector at right how the Connector Element, to which the master gauge is attached, engages a J-slot in the Gauge Valve Element, opening a spring-actuated valve to expose the gauge to well pressure. The operation requires only a minute or two.

Complete details on this money-saving, more efficient well gauging method will gladly be sent on request.

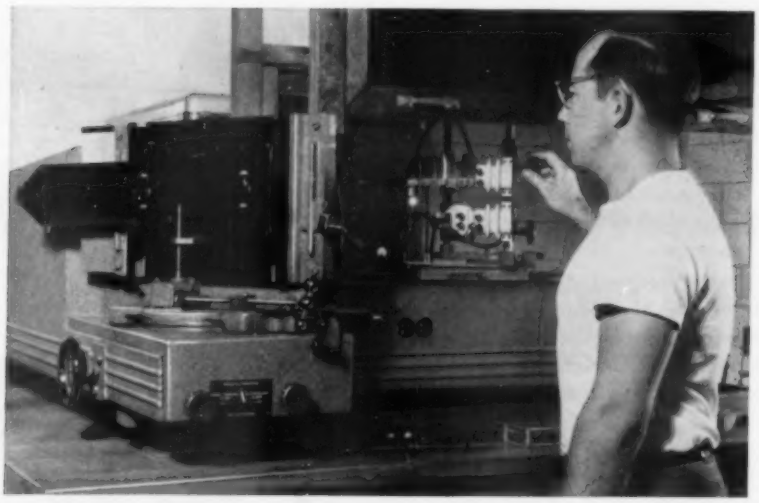


THORNHILL UNIBOLT **CRAVER CO.**

P. O. BOX 1184 HOUSTON, TEXAS

Arsenic in petroleum can be plain murder

Arsenic in catalytic reformer feed stock, even in minute quantities, is deadly. Unless detected and removed it can literally "poison" platinum-containing catalysts, making them ineffective and necessitating costly replacement. UOP laboratories made the first identification of arsenic on poisoned reforming catalysts and evolved a practical method for removing this poison from feed stocks. UOP laboratory service is broad, comprehensive, expert, providing vital information that in most cases would be impractical or economically impossible for the individual refiner to develop. It covers such specifics as the evaluation of crudes, problems of treating products for maximum stability, maintenance of product quality and performance of gas concentration equipment. UOP laboratories answer all the requirements of a thorough and complete laboratory service. Today, refiners everywhere in the free world are users of this laboratory service. It is available to any refiner, regardless of his scope of operation.



This machine is a spectrograph and it is just one of the many modern laboratory tools with which UOP laboratories serve the refining industry. This spectrograph is the very instrument used in the initial detection of arsenic in feed stocks. With the impurity once identified, proper methods for removing it were quickly developed. Through modern services such as this, practical, economical solutions are available to refiners everywhere.

UNIVERSAL OIL PRODUCTS COMPANY

30 Algonquin Road, Des Plaines, Illinois, U.S.A.

More Than Forty Years Of Leadership In Petroleum Refining Technology

what's it worth to have Maneuverability

this DAVIS RIG knows no EQUAL!

EXCLUSIVE FLUSH-DIGGING! Entire mast and boom assembly shifts from center to either side for flush digging alongside buildings, fences, by trees, and other obstructions. Only Davis offers this advanced feature!

YOU ALWAYS FACE YOUR WORK! Seat and control assembly is mounted on mast assembly . . . swing to face the job regardless of operating angle. You work fast because bucket is visible, controls at your fingertips.

Maneuverability more than any other factor governs the time you take to complete a job. That's why you're money ahead with the advanced maneuverability features of a Davis Loader-Backhoe!

Close-in Design Lets You Work in Tight Situations – Your Davis rig hugs close to the tractor – top, bottom, and sides. You have no obstruction to mar your vision. Lets you work with minimum clearance.

Better Visibility Lets You Maneuver with Speed and Accuracy – You don't "feel" your way with a Davis . . . You see the work area clearly as you shuttle from load to dump.

Alert Controls Let You Handle Machine with Ease – All controls are independent and located for fingertip convenience . . . respond lightning-fast to your touch. Ease of handling reduces operator fatigue to increase production.

Works Where Others Won't – The Davis Backhoe's exclusive flush-digging feature and ability to dig at any angle up to 200° often lets you complete a job in the time it takes other makes to get into position.

Davis Loaders and Backhoes are available for all popular models of International, Ford, Fordson Major, Ferguson, Case, Massey-Harris, Allis-Chalmers, Oliver, John Deere, Minneapolis-Moline, and Work Bull Tractors.

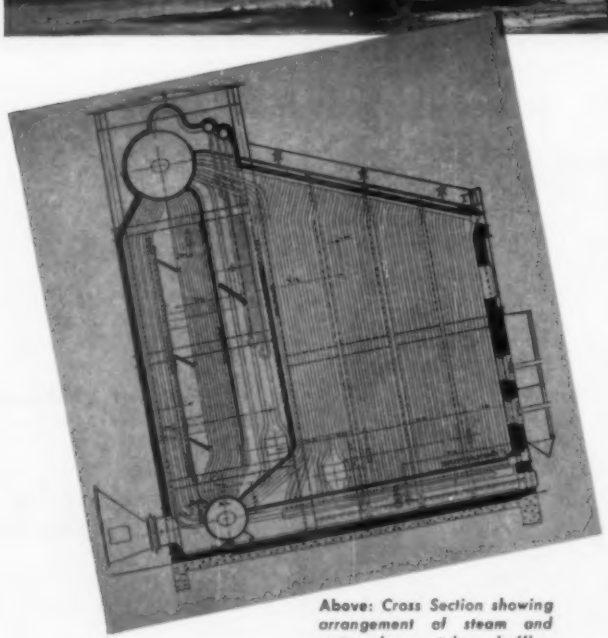
SOLD AND SERVICED EVERYWHERE BY BETTER DEALERS

For the name of your nearest dealers call Western Union by number and ask for Operator 25 . . . or write direct. Please specify make of tractor.

MASSEY-FERGUSON INDUSTRIAL DIVISION
MASSEY-HARRIS-FERGUSON, INC.
1009 S. WEST STREET • WICHITA 13N, KANSAS

Vogt STEAM GENERATORS

at SUNTIDE REFINING COMPANY
Viola, Texas



Above: Cross Section showing arrangement of steam and water drums, tubes, baffles, and furnace.

EFFICIENCY AND ECONOMY PROVED BY FIRST 3 UNITS . . . 2 MORE ADDED!

Principle Data Each Unit

- 85,000 pounds steam per hour capacity, designed for 500 lbs. S.W.P. and 625° F. total temperature.
- Water cooled furnace.
- Burners for Gas and Oil fuel.

Vogt offers a complete line of custom built and package type steam generators. Available in bent tube and straight tube designs for solid, liquid, or gaseous fuels burned singly or in combination.

Write for bulletins. Dept. 24A-BO

OTHER VOGT PRODUCTS

Drop Forged Steel Valves, Fittings and Flanges—
Petroleum Refinery and Chemical Plant Equipment
Heat Exchangers
Ice Making and Refrigerating Equipment

HENRY VOGT MACHINE CO.

Box 1918, Louisville 1, Kentucky

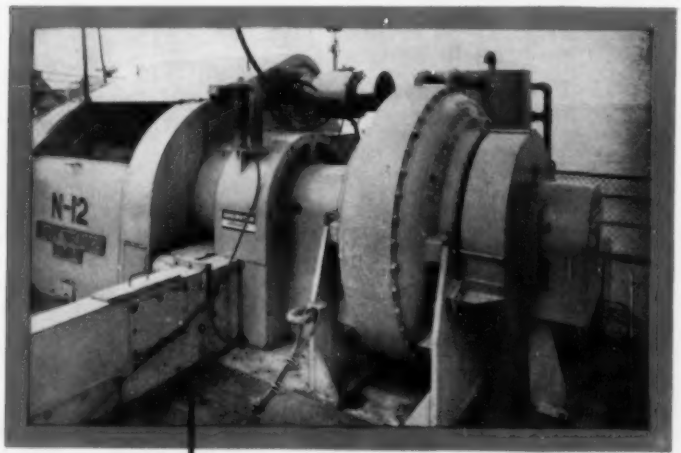
SALES OFFICES: New York, Chicago, Cleveland, Dallas, Philadelphia, St. Louis, Charleston, W. Va., Cincinnati

Only Parkersburg Hydromatic Brake Protects Your Rig Against

"RUNAWAY" PIPE

The Parkersburg Hydromatic Brake is the only drawworks brake that eliminates the danger of pipe running away in case of brake failure. With a Hydromatic Brake, it is impossible for a load to be suddenly dropped. In the first place, as long as the water supply is maintained to the brake, failure is impossible. And should the water supply be interrupted, the water remaining in the brake and supply tank will keep the load on the drawworks in check until the mechanical brake can be applied.

This reserve safety factor costs you no more. In fact, a Parkersburg Hydromatic Brake costs you less to buy and operate. The only parts subject to wear and replacement are minor ones. It also saves wear and tear on wire lines and other drilling equipment.



THE PARKERSBURG RIG AND REEL CO.
PARKERSBURG WEST VIRGINIA
QUALITY SERVICE
PESA

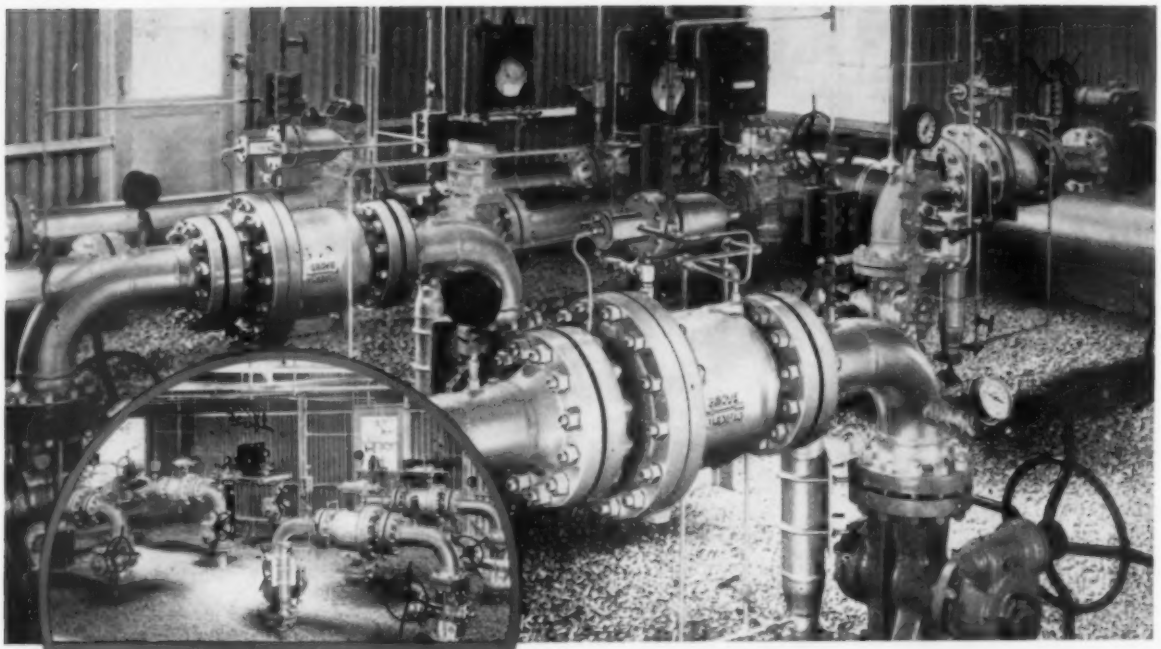
Ask your Parkersburg sales engineer about the safest, most economical drawwork brake made — the Parkersburg Hydromatic Brake.

The **PARKERSBURG** RIG AND REEL COMPANY

DIVISION OF PARKERSBURG-AETNA CORPORATION

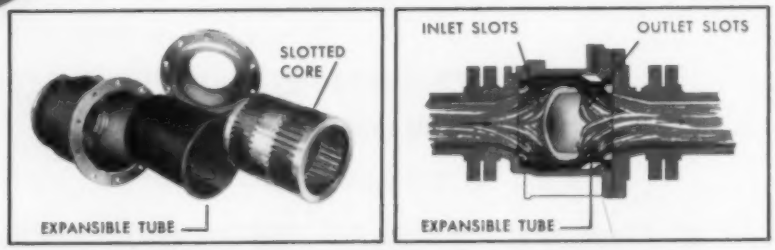
DRILLING and SPECIALTIES DIVISION OFFICES:

P. O. BOX 1160
PARKERSBURG, WEST VIRGINIA



flexflo valves in pressure reducing service at meter stations of major gas pipeline.

The simplest valve of them all



Proved through years of service in PRESSURE REDUCING SAFETY RELIEF, BACK PRESSURE, and a wide range of remote control operations

Grove *FLEXFLO* valves have just one moving part—an expansible tube that's both diaphragm and valve

Even foreign matter which would make conventional valves inoperative, can't disturb the bubble-tight seal created by the expansible tube which closes snugly over the slotted cylindrical core. Pressure is controlled within extremely narrow limits over the full range of rated capacity. There's nothing to stick, slam or bang, so action is sure, responsive and quiet. It outlasts conventional valves many times over, reducing maintenance to a minimum. Adaptable to a wide variety of automatic or manual pilots, *flexflos* are effective for pressures to 1500 psi, temperatures to 150 F, available in iron or steel, 1″ to 12″ sizes. Whatever your flow control problem, check *flexflo* first. 802

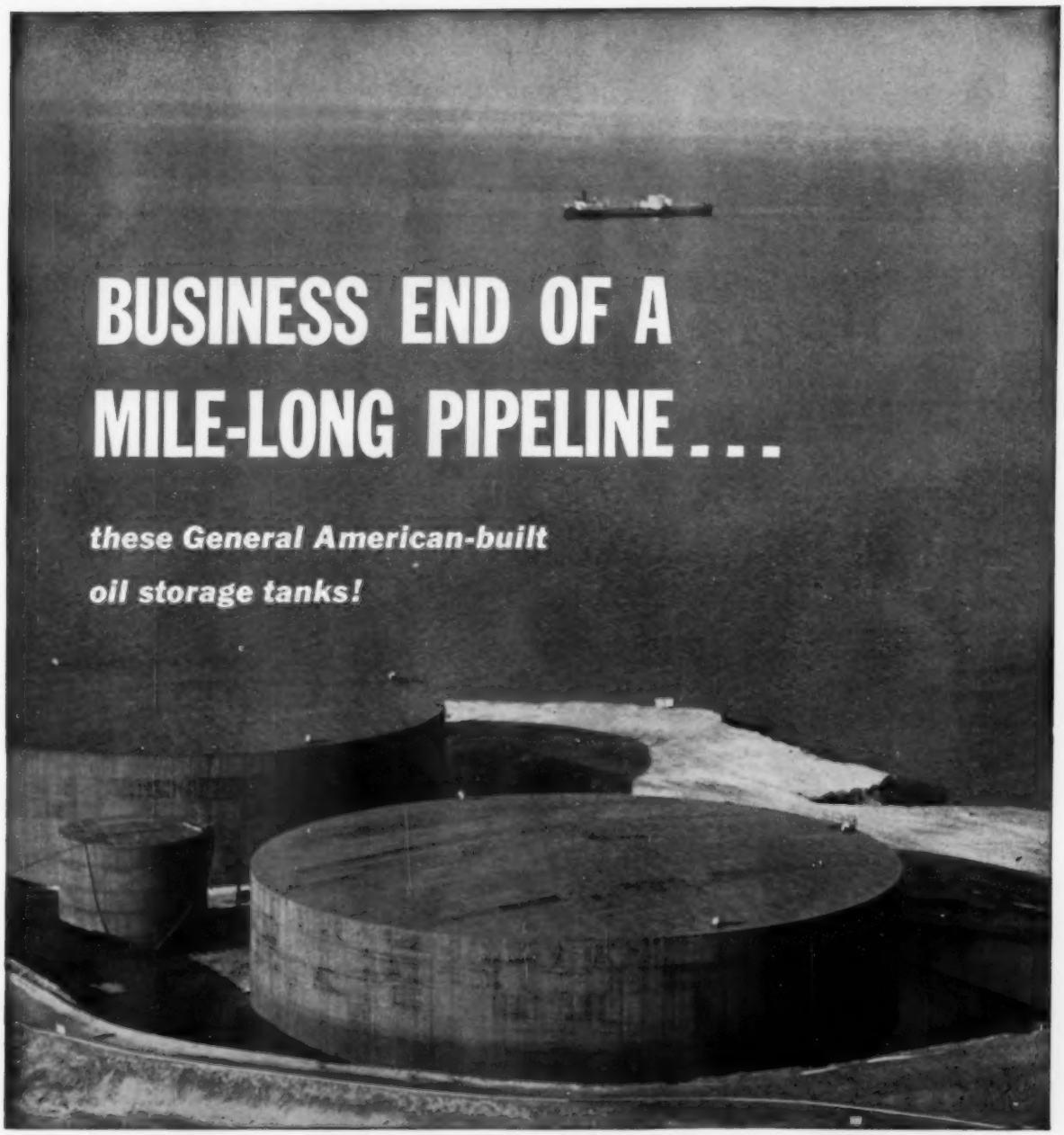
GROVE *FLEXFLO* VALVES

SUBSIDIARY OF WALWORTH

GROVE VALVE and REGULATOR COMPANY • 6529 Hollis St., Oakland 8, Calif.
HOUSTON 4—3517 Polk Ave. • • • **LOS ANGELES 6**—2559 W. Olympic Blvd.

TULSA • CHICAGO • NEW YORK • DENVER • ODESSA • FARMINGTON
In Western Canada: GROVE VALVE LIMITED

GROVE SIMPLICITY ACCURACY SAFETY



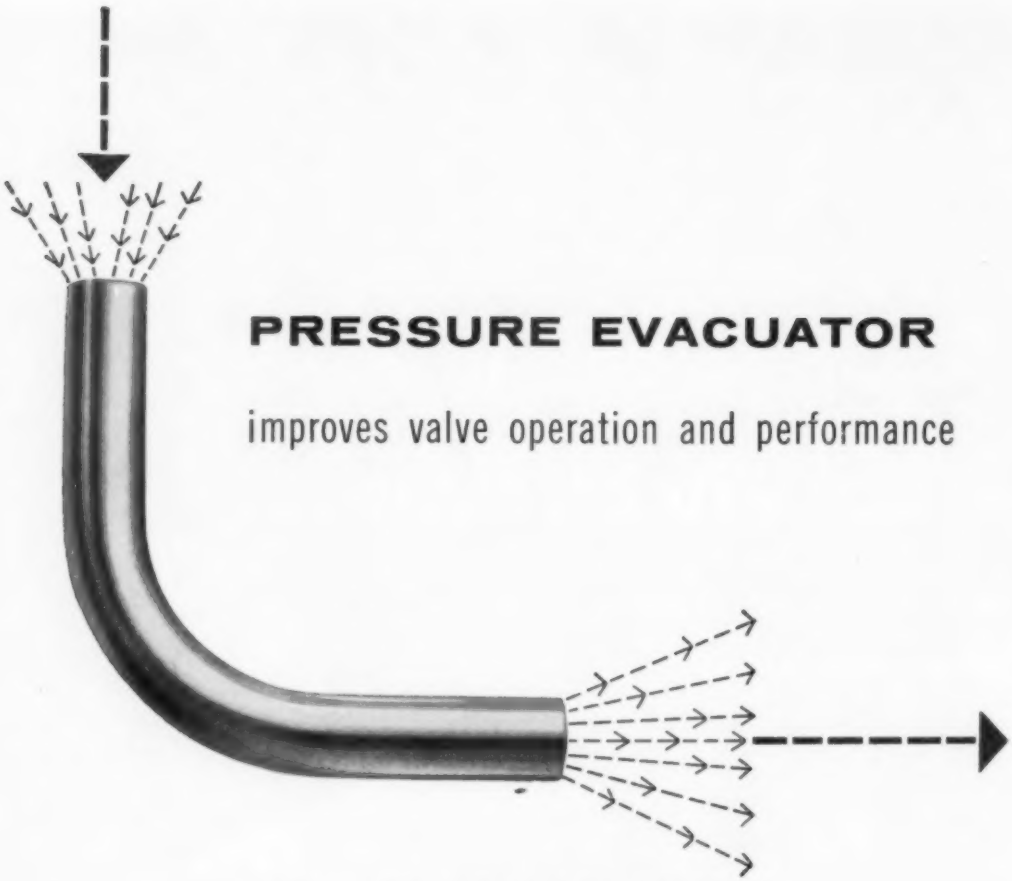
Moored more than a mile offshore in 70 feet of water, even the world's largest tankers (or any tanker presently contemplated) can deliver cargoes direct to these twin 268,000-barrel storage tanks . . . eliminate double handling and costly barging charges.

Each 200 feet in diameter, 48 feet in height, the tanks were custom-engineered, erected on the site by General American's Plate and Welding Division for Northville Dock's new Long Island Terminal. New York State's largest tanks . . . they provide storage for 22,500,000 gallons of oil.

If you need expanded storage right now, or as insurance against future demands, look into the facilities offered by General American. Whatever your storage problem—liquid or gaseous—you'll find . . . *it pays to plan with General American.*

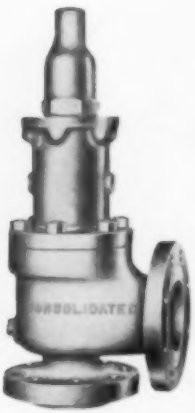
PLATE & WELDING DIVISION
GENERAL AMERICAN
TRADE MARK

PLATE AND WELDING DIVISION
GENERAL AMERICAN TRANSPORTATION CORPORATION
135 South La Salle Street
Chicago 90, Illinois



PRESSURE EVACUATOR

improves valve operation and performance



Consolidated Safety Relief Valve, Type 1900 Series, Sizes: 1" x 2" to 8" x 10".

The Eductor Tube in Standard Consolidated Safety Relief Valves is a pressure evacuator. It efficiently removes pressure from the closed bonnet. If allowed to remain in the bonnet, the pressure would act on the top of the disc and tend to limit the lift and induce cycling. But with the pressure evacuated from the closed bonnet through the Eductor Tube, the spring alone controls valve action. Consequently, *reliable* valve action and guaranteed capacity ratings are attained. A new high in operational dependability is assured.

Reliable operation and performance of Consolidated Safety Relief Valves are your assurance of absolute protection for personnel and equipment. "2 in 1" design permits you to convert the Standard valve to the Bellows type in your own shop. But that is only part of the total economy of these modern valves. Get the complete inside story. Write for Catalog 1900.

MANNING MAXWELL & MOORE INC. TRADE MARK

12-58

CONSOLIDATED SAFETY RELIEF VALVES

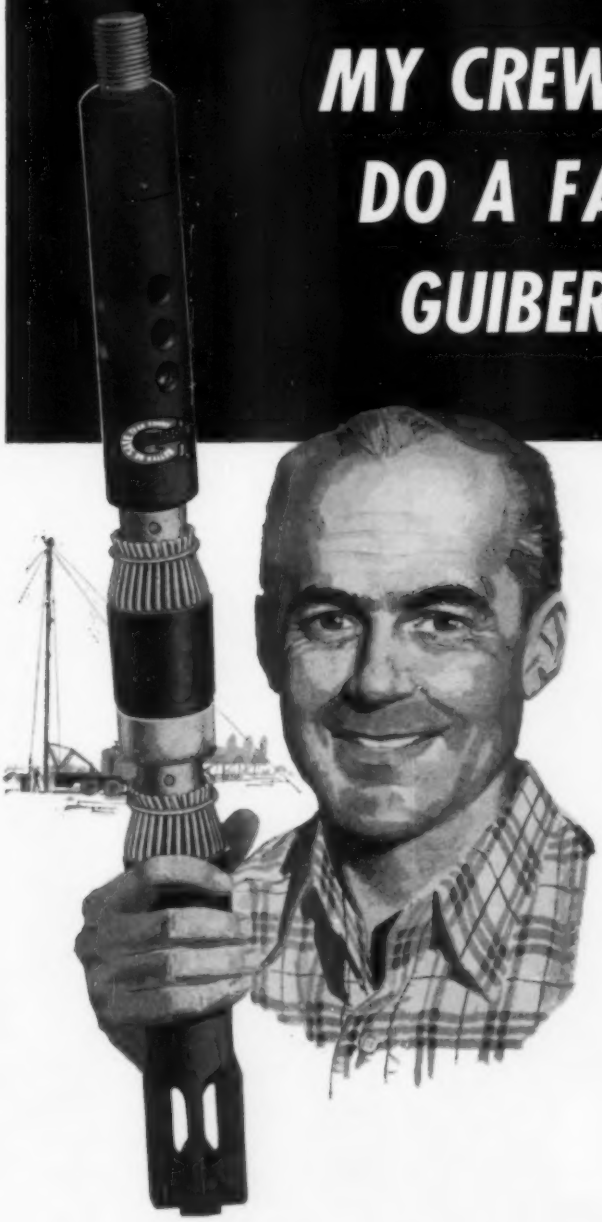
A product of

MANNING, MAXWELL & MOORE, INC.

Consolidated Ashcroft Hancock Division • Tulsa, Oklahoma

In Canada: Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario

MY CREWS DO A FASTER JOB with GUIBERSON SWABS



There's no substitute for a fast-falling, smooth-pulling Guiberson swab in speeding-up swabbing operations. Crews make fewer trips .. do a better clean-out job .. lift more fluid per hour. So naturally they're in and out quicker .. at the *lowest possible* swabbing cost. Match one of these cups to your swabbing job.

TYPE J .. lifts heaviest loads

TYPE L .. lifts medium or light loads

TYPE GW .. for light loads

TYPE K .. general purpose cup to 6,000 feet

SIMPLEX .. lifts fluid containing suspended sand

More than a third of a century of swab-making experience is behind each Guiberson swab and cup. No matter what type of production .. shallow or deep .. light or heavy loads .. smooth, rough or tight tubing .. you will pull more fluid with Guiberson swabs and cups. Regardless of your swabbing problem, you can meet it .. solve it .. quicker and cheaper with a Guiberson swab.

Cups are compounded to Guiberson's exclusive formulas for maximum resistance to oil .. acid .. abrasion.

THE GUIBERSON CORPORATION

ESTABLISHED 1919
DALLAS, TEXAS
U. S. A.

Sold by
Oil Field Supply Stores
Everywhere

C. E. Williams, Gulf Sales Engineer, Midland, Texas, and G. W. Ramsey, Assistant Plant Superintendent, inspect force feed lubricators on one of the modern gas engines at the Goldsmith plant of El Paso Natural Gas Company.

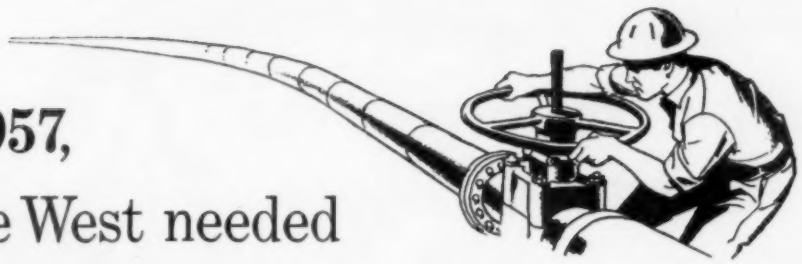
No lubrication problems in 8 years of operation

Since 1949, twenty-seven gas engine-compressor units developing 39,985 horsepower at the Goldsmith plant of El Paso Natural Gas Company have been thriving on Gulf Security Oil. Bearing, ring and cylinder wear maintenance records have been excellent.

Insure safe, more effective lubrication protection for *your* compressor units. Specify Gulf Security . . . the high quality, straight mineral oil. For full information, call your nearest Gulf office.

GULF

GULF OIL CORPORATION, Dept. DM, Gulf Building, Pittsburgh 30, Pa.



In 1957, the West needed MORE ENERGY THAN EVER BEFORE

—and El Paso Natural Gas Company again set records in supplying the West's fastest growing fuel

In 1957, El Paso Natural Gas Company continued its biggest job — finding, transporting and furnishing energy for the West.

More energy was consumed than ever before by the millions of people and by the thousands of industries in this great area.

And natural gas played a bigger part than ever in supplying this energy.

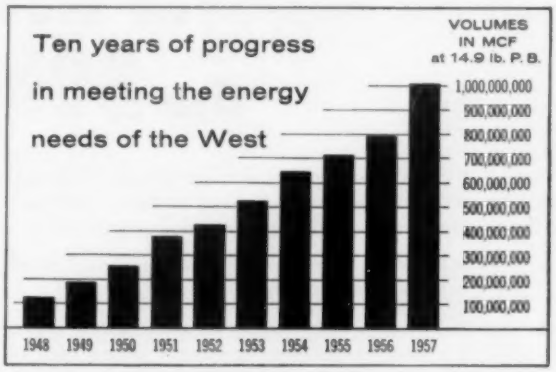
Next year — and in decades to come — the use of natural gas in the West is expected to soar to even higher levels.

Of key importance is the fact that the controlled gas reserves of El Paso and its subsidiary, Pacific Northwest Pipeline Corporation, continue to increase — providing insurance that tomorrow's energy needs will be met. At year's end, such reserves stood at an all-time high of approximately 35.5 trillion cubic feet. And El Paso had completed negotiations with producers for long-term contracts for another 1.8 trillion cubic feet of gas.

These facts and other information relating to El Paso's operations are set forth in the Company's Annual Report for 1957, which has been mailed to 47,800 stockholders. This report summarizes progress made in serving the West in the past year, and includes for the first time operating figures for Pacific Northwest Pipeline Corporation. In 1957, operating revenues reached a record high of $301,090,537, with consolidated net income of $34,506,238. This is equal after dividends on Preferred Stocks to $2.39 per share on 11,795,041 shares of Common Stock outstanding (excluding 5,226,903 shares of Common B Stock which did not participate in dividends in 1957).

Looking to the future, the Annual Report also outlines plans for expansion and describes pending projects (including a 511-mile pipeline from Twin Falls, Idaho, to Las Vegas, Nevada) to increase the volume of gas delivered daily to its markets.

Copies of El Paso's 1957 Annual Report to Stockholders are available by writing to El Paso Natural Gas Company, El Paso, Texas.



In 1957, El Paso Natural Gas Company furnished more than a trillion cubic feet of natural gas to customers in the West — a new record for the Company.

EL PASO NATURAL GAS COMPANY

By Popular Request–

Sherman re-introduces its low cost "C" digger

1500 psi operating pressure
Control valves permit multiple cylinder operation simultaneously
Reach below grade 10', behind rear axle 14' 4", loading height 7' 2"
140° arc of swing
Self equalizing, independently operated stabilizers

in an improved model– the BOBCAT

There are many reasons why the "good old," dependable Sherman "C" was so well liked by excavators and why the new Bobcat will be even more popular—

- The Bobcat has a fast operating cycle, moves earth quickly and economically.
- The Bobcat is extremely stable particularly when working directly behind the tractor where 90% of all digging is done.
- The Bobcat digs close to the tractor, permitting easy maneuverability in tight places.
- The Bobcat is mounted close to the tractor controls, making it easy for the operator to change tractor positions and adjust throttle settings.
- The Bobcat will have a high trade-in value because used Shermans are in big demand.
- The Bobcat is sold and serviced by Ford Tractor Dealers so parts and service facilities are always close at hand.

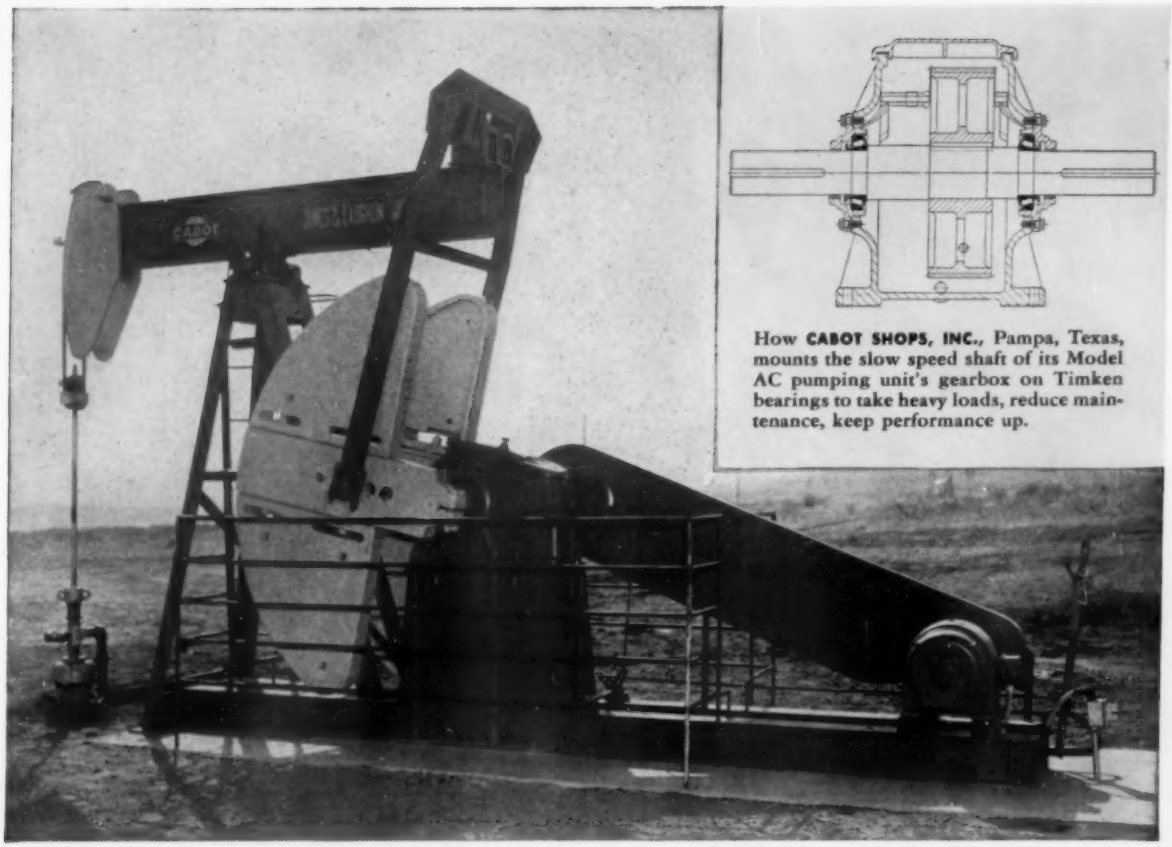
Ask your Ford Tractor Dealer for a demonstration of the low cost Bobcat on *your* job.

Write today for Bulletin No. 1581

Sherman Products

SHERMAN PRODUCTS, INC.
Royal Oak, Michigan

POWER DIGGERS • LOADERS • FORK LIFTS
SOIL WORKING TOOLS • CRANES AND EXCAVATORS



How **CABOT SHOPS, INC.**, Pampa, Texas, mounts the slow speed shaft of its Model AC pumping unit's gearbox on Timken bearings to take heavy loads, reduce maintenance, keep performance up.

How TIMKEN® bearings on slow speed shaft keep pumping unit going in high

IN designing this Model AC pumping unit, Cabot Shops, Inc., faced some tough bearing problems for the reducer's slow speed shaft. Because Cabot reducers have herringbone gears, the bearings must position all shafts. And the bearings on the slow speed shaft must take heavy radial loads. What's more, this equipment must run for years with little attention, making it vital for the bearings to be practically maintenance-free.

To solve all these problems, Cabot engineers specified Timken® tapered roller bearings for the slow speed shaft. The tapered construction of Timken bearings lets them take *both* radial and thrust loads in any combination. And full line contact between rollers and races gives Timken bearings extra load-carrying capacity. Result: end play is minimized. Shafts are held in correct alignment. Gear wear is cut. The pumping unit works steadily, economically.

And because Timken bearings hold housings and shafts concentric, bearing closures are more effective. Lubricant stays in. Dirt and moisture stay out. Lubrication costs stay down.

Another big reason Timken bearings stand up so well is that they're made of electric furnace Timken fine alloy steel. A further guarantee of highest quality. We're America's only bearing manufacturer that makes its own steel.

Get the same precision, long life, money-saving bearings that Cabot Shops and so many other manufacturers do. Specify Timken bearings for the machines you buy or build. Look for the trade-mark "TIMKEN" on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS ROLL THE LOAD

"$7,000,000 rig... and the rotary hose is U.S. Royal 4"

reports "Red" Royal

That's "Red Royal" being hoisted aboard Mr. Gus II, world's largest offshore drilling rig. Owned by the C. G. Glasscock Drilling Co., Mr. Gus II has record-breaking statistics: it operates in depths up to 150 feet, has air-conditioned quarters on all 3 decks to accommodate 66 men, has a length of 259 feet (including anchor supports and space for helicopters) and 8000 barrels capacity drilling water.

Because this hard-working mammoth requires the champ rotary hose in the industry, U.S. Royal 4 was selected—not only for its unequalled record on barge rigs, but also for its performance in the patches throughout the oil fields.

For rolling up top footage, no matter how tough the going, specify U.S. Royal 4 Rotary Hose. It's built to handle the highest pressures on today's pumps—which means you can use it all the way from spud to pay.

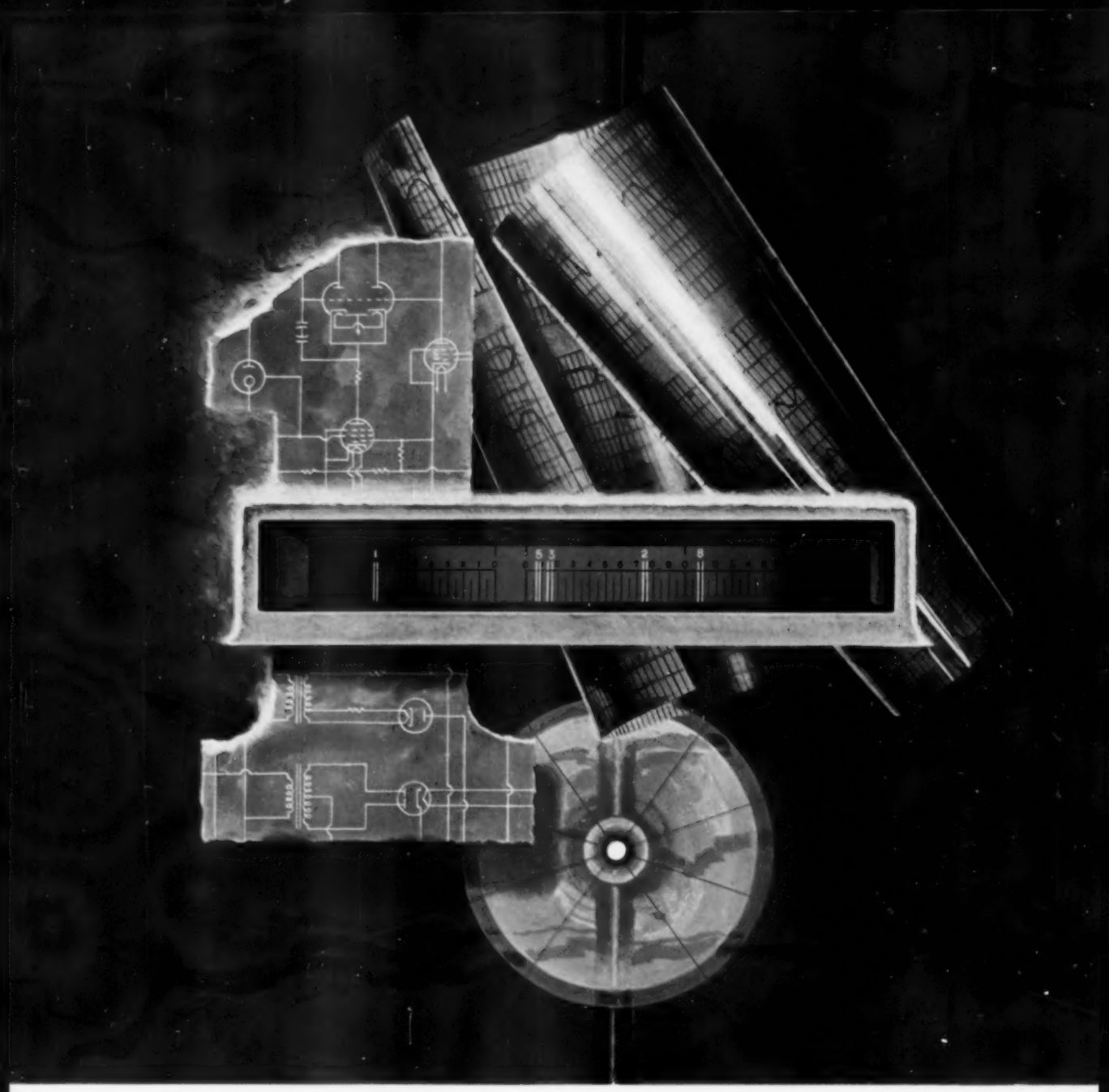
Available in all fields at supply stores.

US RUBBER

Mechanical Goods Division

United States Rubber

See things you never saw before. Visit U.S. Rubber's new Exhibit Hall, Rockefeller Center, N.Y.



So you can look where you can't see

Oil industry technology took a big step forward when the Schlumberger Electrical Log was developed. Ever since the day oil was discovered, man has "strained his eyes" to see underground in an effort to accurately determine oil deposits.

The basic Schlumberger Electrical Log gave the industry eyes to see with . . . eyes that have been the first to see most of the present oil reserves throughout the world.

The Schlumberger Electrical Log . . . the pioneer system for all logging techniques . . . has been refined and improved year after year, along with resulting companion services. It is a quick, economical and accurate method of securing a permanent record of the formation penetrated. It is the master key to successful exploration.

When you call Schlumberger, you can be sure of the most reliable electrical log in the field and the best service obtainable. No other electrical log can ever give you Schlumberger quality.

THE EYES OF THE OIL INDUSTRY®

SCHLUMBERGER

MILLION DOLLAR DIVE...

OFF CALIFORNIA a geologist-frogman dives deep to the ocean floor in search of petroleum-bearing rock for Texaco.

If successful, America's oil reserves may be richer by millions of barrels.

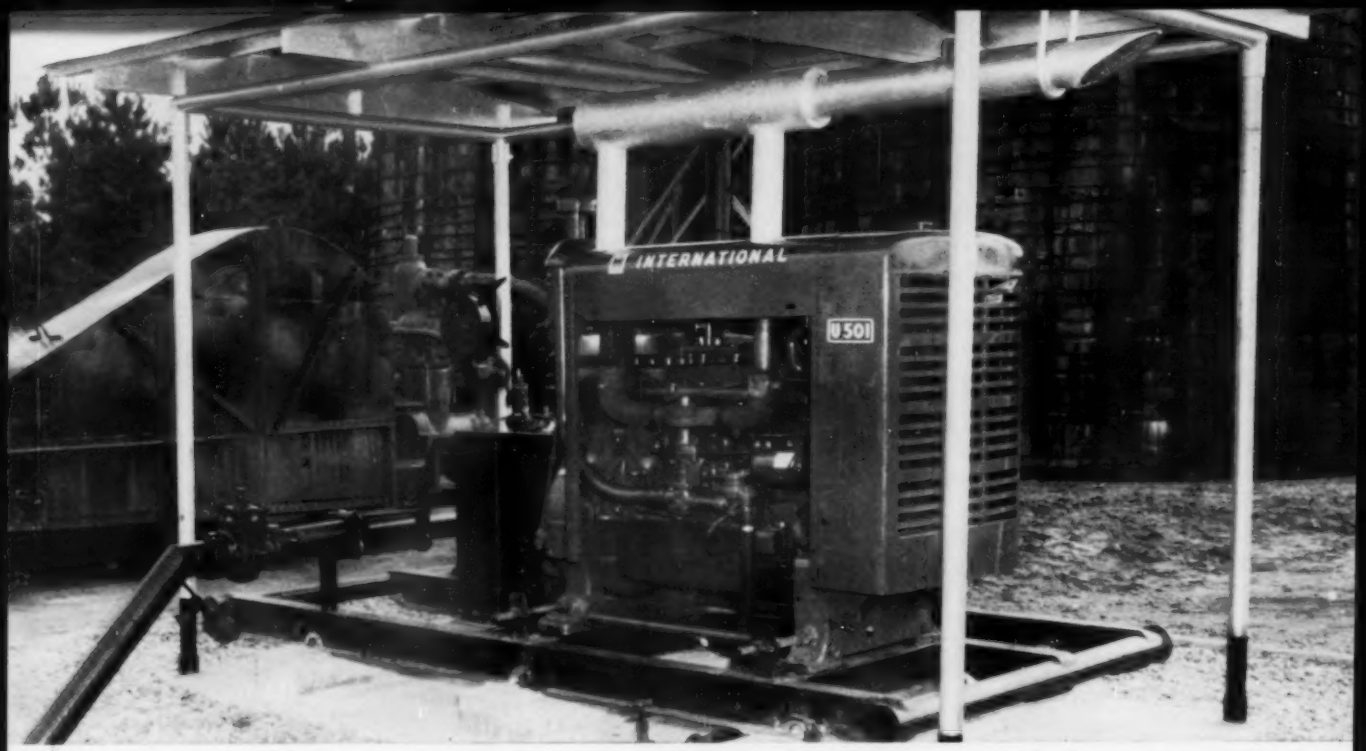
On five continents Texaco oil explorers are using aerial surveys, artificial earthquakes, soil analysis and other methods to locate more oil to satisfy the ever-increasing world demand.

This work is just one phase of Texaco's multi-million dollar program to produce more and finer petroleum products for the transportation, rubber, petrochemicals and plastics industries...an investment in the future.

THE TEXAS COMPANY

Progress . . . at your service

TEXACO



This natural gas U-501 6-cyl. power unit with Gould pump injects 85,000 gallons of waste salt water into six dry wells daily for the Ohio Oil Co., Haynesville, La. Process aids recovery of hard-to-get oil.

International repowering proves profitable on drill rig, pump

Producer, drilling contractor get more for their power dollars by changeover to heavy-duty, dependable International engines

Twin International U-450 power units drive the drill rig and mud pump for J. P. Crain on this operation near Stevens, Ark. About 750 feet of 7⅞" pipe is put into the ground every 24 hours.

A large producer and a drilling contractor recently made similar discoveries about practical advantages of repowering equipment with dependable, heavy-duty International engines.

At Haynesville, La., the Ohio Oil Company could inject salt water into only one pumped out well with an old engine. Now, with a new International U-501 6-cyl. engine on a Gould two-stage centrifugal pump, 85,000 barrels of salt water is injected daily into six wells, up to three miles from the gathering pit.

In the Pace City field, Stevens, Ark., drilling contractor J. P. Crain, Moorings Port, La., found he could increase production with no increase in cost by repowering with International. He bought two new International U-450 engines for the same price he originally paid for the replaced single engine on his Wilson Sr. rig and 5" x 10" Gaso mud pump. But now increased drilling power lets him finish off a 2,900-foot well in just four days.

Get more for your power dollars at repower time by getting the facts on heavy-duty, dependable International oil field engines. Your International power Unit Distributor or Dealer can show you 14 natural gas engines from 10.5 to 248 hp or 11 models from 28 to 215 hp that operate on LP gas. See him soon.

International®

International Harvester Co.;
180 North Michigan Ave., Chicago 1, Illinois

Construction Equipment

A COMPLETE POWER PACKAGE: Crawler and Wheel Tractors . . . Self-Propelled Scrapers . . . Crawler and Rubber-Tired Loaders . . . Off-Highway Haulers . . . Diesel and Carbureted Engines . . . Motor Trucks . . . Farm Tractors and Equipment.

It wasn't so deep...

but it was tough...

and the chips were down

Experience made the difference, just as it has so many times—on so many wells. *Experience* . . . the magic qualification that can be claimed by so few, in any industry. When it really counts . . . and *every potential producer* does count . . . experience can mean the difference in getting the facts.

Whether the hole is shallow or deep, the job is simple or tough, you get added benefits with Johnston . . . the most sensitive pressure recorder available built into testing equipment designed to withstand any down-hole condition . . . well trained, qualified testing personnel . . . unmatched service . . . evaluation that sets the industry standard. All this, plus experience gained from thirty years of drill stem testing and over one half million testing operations, is yours when you call Johnston. There is a difference in drill stem tests . . .

And Johnston experience makes the difference.

When the stakes are high is no time to call in the second best drill stem testing company . . . no time to shop for a cheap test. If you can justify a drill stem test, you can justify the best.

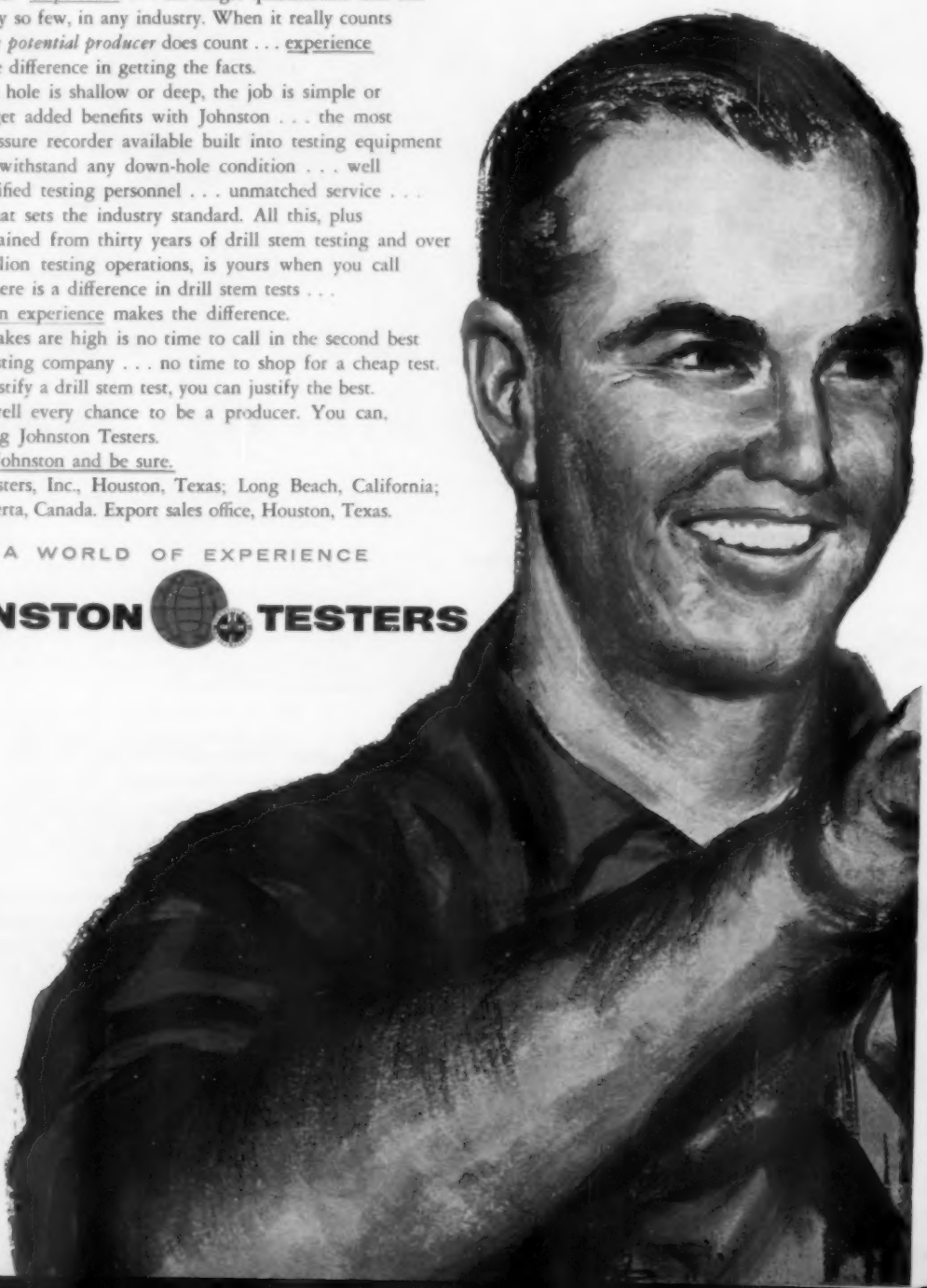
Give your well every chance to be a producer. You can, just by calling Johnston Testers.

Always call Johnston and be sure.

Johnston Testers, Inc., Houston, Texas; Long Beach, California; Calgary, Alberta, Canada. Export sales office, Houston, Texas.

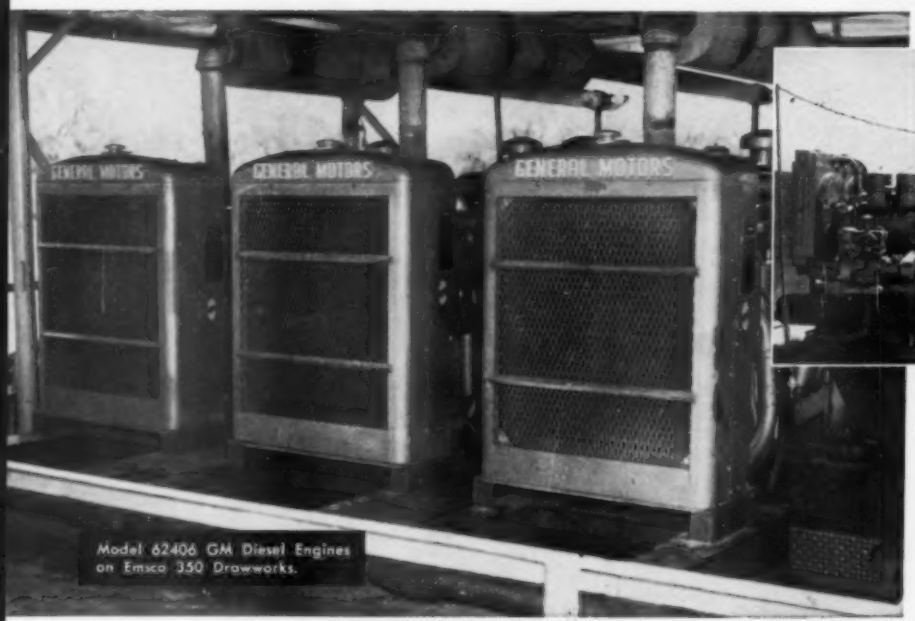
A WORLD OF EXPERIENCE

JOHNSTON TESTERS

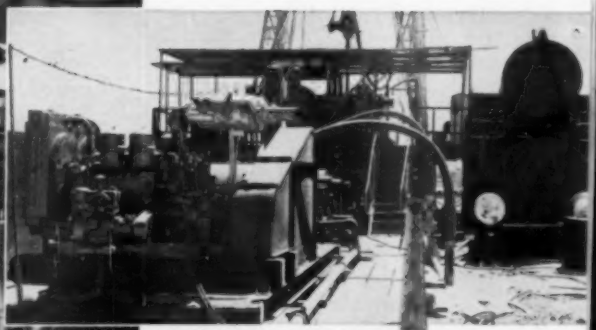


JOHNSTON
TESTERS

DEPENDABLE POWER



Model 62406 GM Diesel Engines on Emsco 350 Drawworks.


Model 12103 GM Diesel Engine on Standby mud pump.

South States Drilling Company's Rig No. 4 in the Longview area.

STORY OF A "REVITALIZED" RIG

When South States Drilling Company, Longview, Texas, decided to repower their Rig No. 4, they chose Stewart & Stevenson GM Diesel Power through Industrial Power & Supply. Gas/butane powered engines formerly were used.

The results?

"We noticed a decided improvement in power and acceleration," Mr. B. J. Baird testifies, "particularly in coming off bottom with a heavy string of drill pipe. We were able to reduce our trip time considerably."

Rig No. 4 has an Emsco GA 350 Drawworks with a 7¼-inch by 14-inch Gardner-Denver mud pump. This was repowered with three 6-110 GM Diesel Engines. Also, Rig No. 4 has a B-14 Emsco mud pump for stand-by service powered by a Model 12103 GM Diesel Engine.

This drilling contractor found the pump on the compound could be used to its rated capacity after the repowering job. This is without loss of drilling power on the rotary table.

Economy: "A 40% savings over our past operation," Mr. Baird says.

Overall performance: "Well pleased."

Service: "Excellent."

Stewart & Stevenson Services, Inc., the world's largest distributor of diesel engines, has the answer to your drilling power needs, regardless of the size or type of your rig.

A combination of the right power and utmost efficiency in service means more efficient operations for you. And that's money in the bank.

STEWART & STEVENSON

STEWART & STEVENSON SERVICES, Inc.

Main Office and Plant:	4516 Harrisburg Blvd., Houston 11, Texas Phone CApitol 5-5341
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We're proud of our record in meeting every power need for the nation's leading drilling contractors

THE WORLD'S LARGEST DISTRIBUTOR OF DIESEL ENGINES

ONLY SIKORSKY HELICOPTERS ARE FULLY PROVED IN HEAVY-PAYLOAD COMMERCIAL SERVICE

PUBLIC UTILITIES such as Southern California Edison Co. and Pacific Gas and Electric Co. have used Sikorsky S-58s to airlift steel, concrete and other equipment for construction of power transmission towers and distribution lines in almost inaccessible areas. Above, an S-58 positions a distribution line pole in the Santa Ynez mountains of California.

Only Sikorsky helicopters have proved their versatility and dependability with years of heavy-payload commercial service.

Shuttling two-ton loads of vital cargo speedily and efficiently to strategic but isolated sites . . . carrying more than 230,000 passengers yearly to and from offshore drilling rigs . . . eliminating costly and time-wasting road building through jungles or mountains . . . Sikorsky S-58s and S-55s are doing the man-sized jobs. Performance specifications are endorsed by years of real commercial service, and are not based on theory or demonstrations alone.

If your project takes you into jungles, the Arctic, offshore or to any other hard-to-reach areas where transportation is a costly problem, rugged Sikorskys can give your operation new flexibility and new efficiency. Write for complete information.

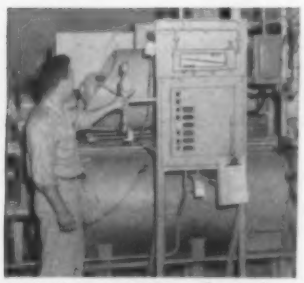
OIL COMPANIES operating offshore and in remote areas use only Sikorskys for big and demanding jobs. In the New Guinea jungle, for instance, S-58s are transporting crews, sectionalized rigs, machinery and everything needed for construction and operation of well drilling rigs. Here an S-58 carries a mud tank weighing over two tons.

SIKORSKY AIRCRAFT
STRATFORD, CONNECTICUT
One of the Divisions of United Aircraft Corporation

Interior of Kemp Generator in action

Burned up by inert gas costs?

Come to Kemp



This Kemp 30,000 cu. ft. per hr. Inert Gas Generator meets all purging and blanketing needs at Gulf Oil's Port Arthur plant. Complete safety is assured with the more-than-adequate supply provided by the generator. Refineries everywhere depend on Kemp equipment.

Kemp Inert Gas Generators end the trouble and expense of bottled gas, provide a highly flexible source of supply at a fraction of the cost. With Kemp generators in your operation, you can make liberal use of inerts . . . apply them to the improvement of many other operations. There are Kemp units to manufacture inerts in any quantity, for any application.

Kemp equipment is dependable. You get rugged design, simplicity of operation, and almost complete elimination of maintenance. Each unit is completely protected with safety devices. The heart of the generator is the famous Kemp Carburetor, for precise control of inert quality, regardless of system demands.

Kemp produced inerts belong in your plant . . . for blanketing, purging, and protective uses . . . agitation of batches during cooking . . . conveying combustibles and controlling reactions.

For new installations or modernization programs, call in your Kemp Representative. Or write us for Bulletin I-10. The C. M. Kemp Mfg. Co., 405 E. Oliver St., Baltimore 2, Md.

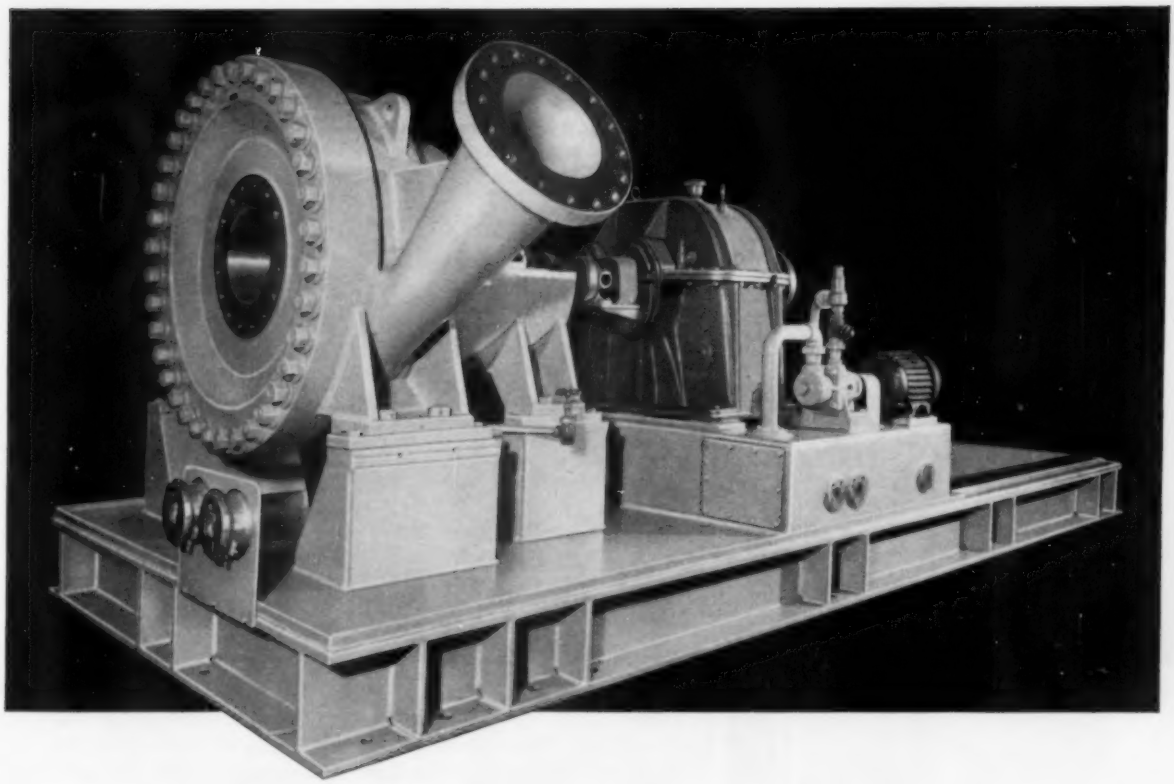
Kemp Convection Dryers

Kemp Immersion Melting Pots

KEMP OF BALTIMORE

Kemp Industrial Carburetors

Kemp Oriad Dryers



NEW

Single-Stage Barrel-Type
Allis-Chalmers Compressor

Boosts High Pressure Gas to Higher Pressure Levels in Range of 50 to 500 psia.

THIS new Allis-Chalmers development extends the range of single-stage compressors into high pressure levels previously handled by reciprocating type units.

The new compressor has all the advantages of a centrifugal compressor — compactness, pulsation-free operation, few wearing parts, easy maintenance.

The unit shown above, now in successful operation, boosts 3690 cfm of air from an inlet pressure of 185 psia to a discharge pressure of 240 psia. It is driven through a speed-up gear by an Allis-Chalmers 1250-hp motor.

The casing consists of three principal parts: the casing cylinder, a bolted casing head and a fabricated casing pedestal. A diaphragm which forms the gas diffuser passage is inserted into the casing cylinder. Excellent gas sealing is assured, since there is only one shaft extension and only one casing joint to seal against gas pressure.

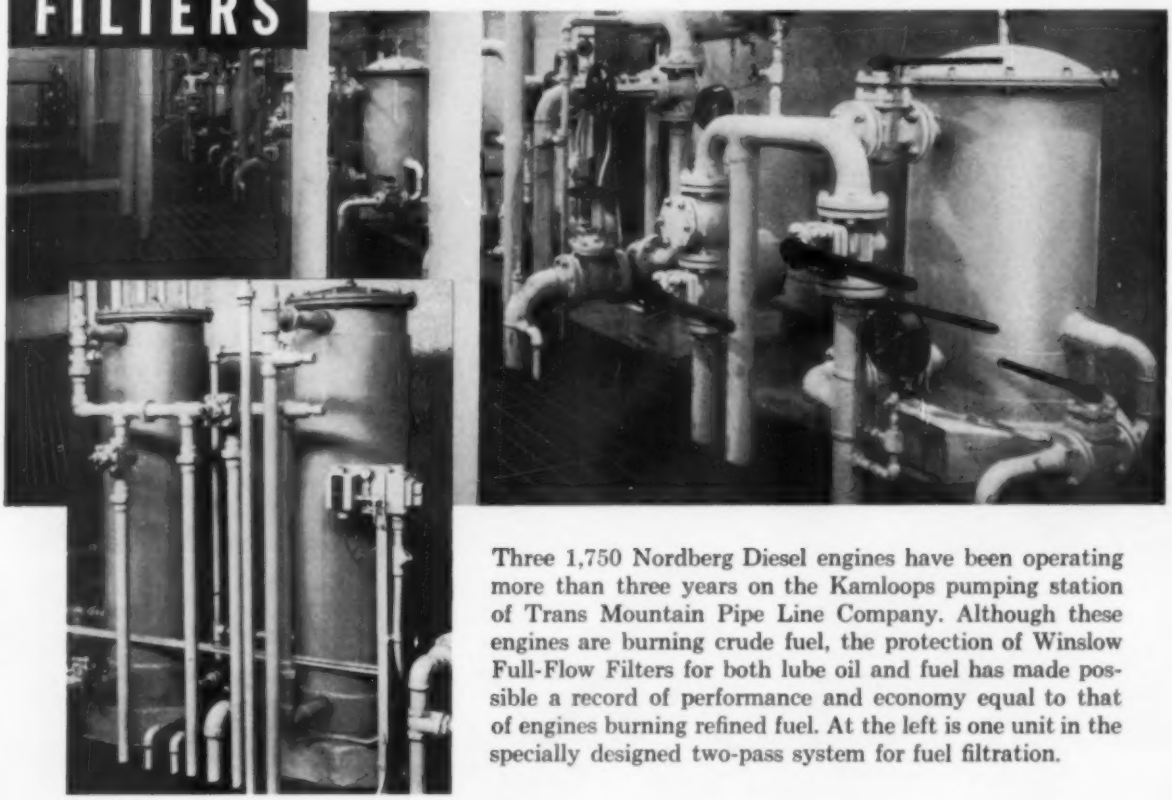
For details, including a sectional view of this new compressor, call your nearby A-C representative, or write Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

A-5728

WINSLOW *Full-Flow* FILTERS

Case History Report No. 34 Shows Why Engines Protected by WINSLOW FILTERS Last Longer



Three 1,750 Nordberg Diesel engines have been operating more than three years on the Kamloops pumping station of Trans Mountain Pipe Line Company. Although these engines are burning crude fuel, the protection of Winslow Full-Flow Filters for both lube oil and fuel has made possible a record of performance and economy equal to that of engines burning refined fuel. At the left is one unit in the specially designed two-pass system for fuel filtration.

20,000 HOURS OPERATION—Parts Replaced ONLY $300

CP* FILTRATION

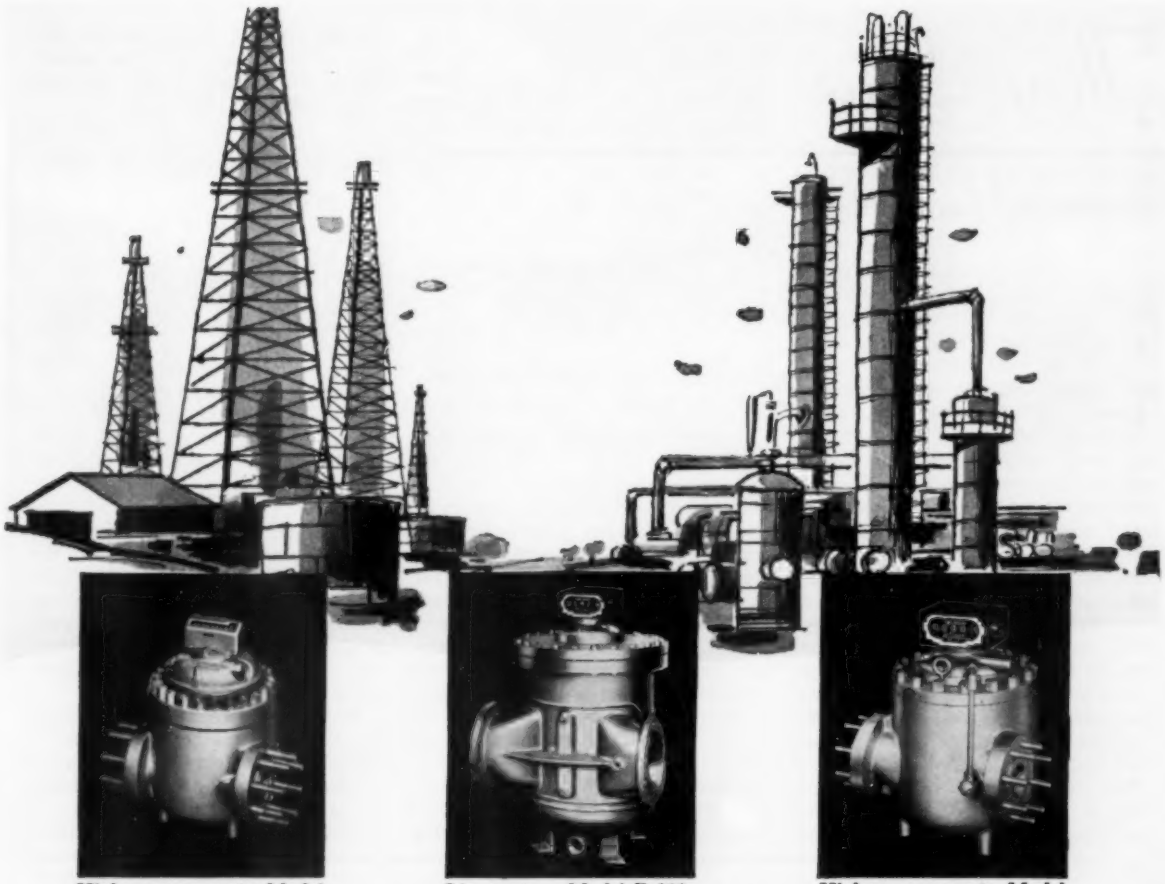
Winslow patented CP* (Controlled Pressure) elements are designed to continuously self-adjust the pressure within the filter and allow for a full stream of filtered oil without opening by-pass valves. This is accomplished through the dual flow capacity, with two types of material.

After 20,000 hours operation in a three-year period, the first Nordberg Diesel in a Trans Mountain Pipe Line station was recently overhauled. In spite of the use of crude fuel, and difficult operating conditions, the engine was in such good condition that only $300 worth of replacement parts was required. This is another striking example of the long engine life and the substantial savings in overhaul time and replacement costs when dirt, acid, moisture and other impurities are removed by Winslow Filters. Standard or special installations of Winslow Full-Flow Filters can give you equal engine economies. Please write for complete information.

CP is fully protected by patents and trademarks*

WINSLOW ENGINEERING & MANUFACTURING COMPANY

4069 Hollis Street, Oakland, California



High-pressure meter Model M-12. M Series meters for working pressures up to 1200 psi, 120 gpm.

Line meters. Model B-200, shown, has capacity of 3000 bbl/hr. New Model B-700 — 10,000 bbl/hr.

High-pressure meter Model D-35. D-Series meters for working pressures up to 600 psi, capacity 350 gpm.

For wellsite or refinery, rely on A. O. Smith Meters . . .

for uninterrupted high flow and sustained accuracy

RIGHT to the LAST drop

The day you install A. O. Smith high-pressure meters is the day you start to gain. A. O. Smith meters help safeguard against loss in production, processing and delivery because they're as close to being foolproof as modern science can make them.

With A. O. Smith meters on the line — anywhere from wellsite to service station—you can be sure of accuracy that gives you readings "right to the last drop."

Why not see for yourself. Get in touch with your representative or write direct for comprehensive details.

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A. O. Smith International S.A., Milwaukee 1, Wis., U. S. A.

Turn page to see . . .

. . . HOW WE WORK STEEL TO MAKE STEEL WORK FOR YOU

They Say

"Costimating" hard to find

Dear Sir:

As a regular clipper of cost data, I would like to make a few suggestions about the handling of "Costimating." You did not always treat the recently closed series with uniformity and a new lengthy series is commencing.

Could you:

1. List "Costimating" and the "Nelson Index" in a uniform way in the table of contents. Sometimes the page reference is in "Technology - Operation," sometimes in "Departments." The "Nelson Index" has been a department, an article, and sometimes both.

2. Be sure a "Costimating" numbered article has a number. You omitted this detail on No. 4 and No. 22 of the last series, and it would have been easy to have missed them.

3. Have the "Index" in the issue for which it is promised.

The "Costimating" articles and the "Nelson Index" are a valuable and sometimes indispensable part of my working tools and are the best answer I have found to the problem of quick cost estimates.

R. E. Dillon
Goliad Corp.
Houston.

"Costimating" now corrected

Dear Sir:

In reference to your "Costimating" article in the April 7, 1958, issue of The Oil and Gas Journal (p. 165), a discrepancy was noted in the 1954 and 1956 "Itemized Cost Index" for exchangers when compared to your previous index of January 6, 1958.

We will continue to use your index of January 6, 1958, for estimating purposes; however, we would appreciate your investigating the above matter and notifying us of your results.

Edward H. Thayer
Socony Mobil Oil Co., Inc.
New York.

Editor's note: We failed to insert a footnote on the April 7, 1958, Itemized Cost Indexes page, stating that the April 7 values are revised (and corrected) indexes. The values shown in the April 7 issue are the correct values.

How to cut production costs

Dear Sir:

Oil produced in the United States is a high-cost product that cannot compete economically on the world market; much of this high cost is unnecessary technologically, and something can be done about it.

The long-term health of the oil industry depends much more upon our recognizing this and taking effective action to reduce the cost of our product than upon short-term palliatives like import controls and reduced allowables. . .

The biggest reason domestic oil cannot compete with foreign is the fantastically inefficient use we make of investment capital. We begin by drilling several times as many wells as are necessary physically to produce the oil because of arbitrary well-spacing regulations.

These spacing rules are not based on the reservoir area that each well is physically capable of draining or on the economic cost of recovery oil, but on outmoded rules of thumb.

Then, after investing perhaps three

A. O. Smith products for

A. O. Smith line pipe has always been manufactured to a high standard of quality for almost 30 years... precisely controlled at every step of production. That's why A. O. Smith pipe, made and installed in 1928, is still in operation. That's why so much A. O. Smith pipe is in nearly every important high-pressure line.

The above photo shows a collapsed specimen of 9⅝" S-95 casing being removed from the testing well. The high collapse value of A. O. Smith casing has been maintained by a continuous program of research and testing. As a result of this program, S-95 casing has gained wide acceptance for use in deep wells.

HOW WE WORK STEEL TO MAKE STEEL WORK FOR YOU . . .

times the necessary amount in development wells, we produce them less than half the time in Texas and even then far below their maximum efficient rate. . .

The first and most important step toward making well investments realistic is simply to bring the concepts under which the state regulatory bodies work up to the level of present-day technology and economics. The use of maximum economic well spacing must be encouraged, yet the rights of the small owner have to be protected.

Perhaps this could be initiated by basing the allowable for new wells almost entirely on acreage, with no mandatory shut-down days. Old wells would have to be allowed to produce out their years under the old rules. . .

It is impossible to state offhand how much the price of crude might be reduced by state regulation designed to foster the most efficient use of investment capital. It does seem possible, though, that the number of future development oil wells might be reduced to no more than one-third the number required under the present well spacing.

This should allow the total capital investment in each barrel of oil in the ground to be about halved. . .

With half the investment . . . costs would be reduced proportionately, so the price of crude might be reduced from, say, $3 per barrel to $2 without reducing "profits." This is purely an order-of-magnitude figure to indicate that the potential price reduction might be of very significant size. . .

The state regulatory bodies and leaders in industry and government should demonstrate the quality of their leadership by helping to put the domestic oil producing business back on a competitive economic basis through reduction in all costs, especially in capital investments costs. . .

We should do this now during the respite furnished by import controls, which are at best a temporary expedient subject to the whim of politicians. . .

DeWitt C. Van Siclin
Bellaire, Tex.

What the railroads want

Dear Sir:

I am a regular reader of The Oil and Gas Journal and have a high regard for its accurate reporting of news. One of its principal attractions is Mr. Linz's column "Watching Washington," but I was quite disturbed by several misstatements which appeared in that column in your March 24 issue (p. 93). . . .

It was stated . . that the railroads are asking Congress for two privileges: One, to permit them to set freight rates without going to the Interstate Commerce Commission; and the other, to permit them to engage in any form of transportation, including water . . .

This statement may create an erroneous impression . . . The railroads are not seeking authority to establish freight rates without resorting to the ICC. The legislative proposal advocated by them relates only to giving all carriers greater freedom as to the minimum rates to be charged.

Under the proposal, rates unreasonable because excessively high, or discriminatory as between different classes of shippers, would continue to be unlawful, as would rates so low as to be noncompensatory.

The rates would be initiated by the railroads. But they would be subject to suspension and investigation by the commission upon complaint of any interested person or at the instance of the commission itself . . . to ascertain whether they conform in all respects with the standards . . . (of) the Interstate Commerce Act, as modified solely with respect to minimum rates.

Neither do the railroads ask carte blanche authority to engage in any form of transportation, including wa-

petroleum progress

For 30 years, petroleum and chemical industries have come to us with pressure vessel and heat exchanger problems. They've discovered that working with our resourceful scientists and research technicians...creative design engineers and expert manufacturing personnel ...is a mutually rewarding experience. A pleasant and *profitable* way to project solutions.

Want more facts about all A.O. Smith products for the petroleum industry? Write for free, illustrated brochure, "OIL." A. O. Smith Corp., Milwaukee 1, Wisconsin.

Whatever the motor requirements, you'll find the right answer in A. O. Smith's complete line of application-engineered electric motors. Fractionals, integrals, vertical hollow-shafts, gear motors, etc. — 1/3 thru 800 hp.

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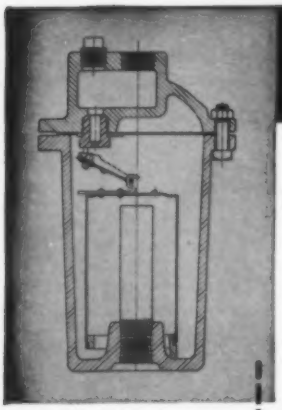
...HOW WE WORK STEEL TO MAKE STEEL WORK FOR YOU

LIQUID LEVEL CONTROL OF CORROSIVE LIQUIDS?



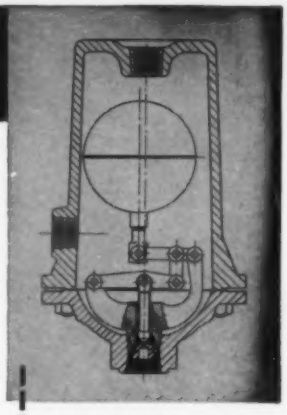
INVERTED BUCKET TRAPS with light weight buckets for draining light liquids from gases. The same design and operation proved on thousands of steam trap applications.

. . . These ARMSTRONG TRAPS are the Maintenance-Saving Answer

ARMSTRONG traps extensively have been used to drain corrosive liquids from receivers and maintain the liquid level at any desired point. Bodies and caps have been furnished of nickel, aluminum-bronze, monel, stainless steel and other metals which can be cast or forged. Working parts, also, have been of nickel, monel, stainless steel or any weldable material available in sheet, rod and bar form.

Traps made of low carbon chrome iron, for example are being used to drain 60% Nitric acid from receivers at 75-100 psig. Perhaps you have a corrosive liquid control problem that can be solved with Armstrong traps. For complete data write:

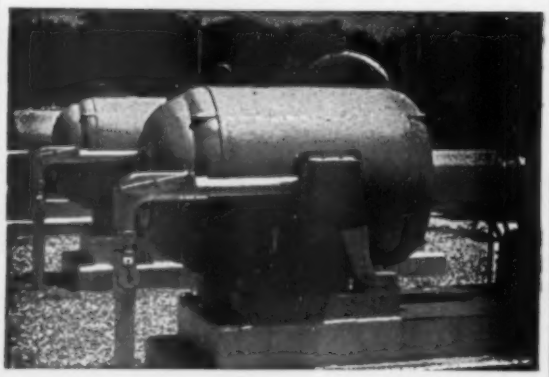
ARMSTRONG MACHINE WORKS
8687 Maple Street • Three Rivers, Michigan



BALL FLOAT TRAPS with compound or direct lever mechanism for draining water or light liquids from gases or other liquids. Also widely used for air or gas relief service.

ARMSTRONG STEAM TRAPS • AIR TRAPS • GAS TRAPS
AIR RELIEF TRAPS • LIQUID LEVEL TRAPS

EXPLOSION PROOF MOTORS



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You get Specialized Management
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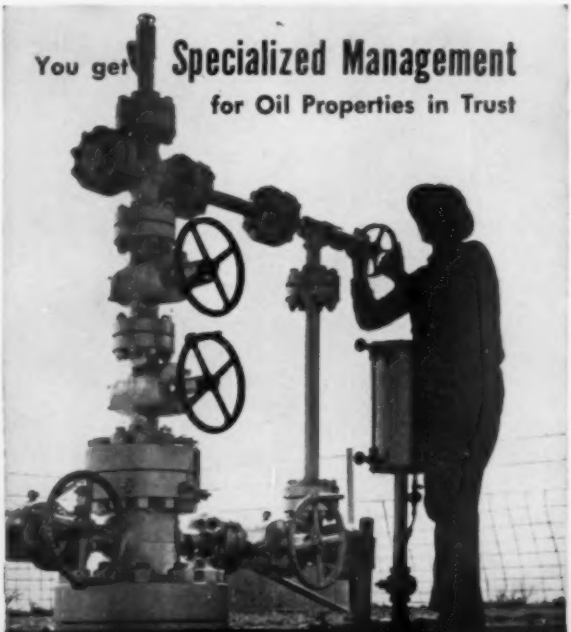

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Mercantile National Bank
Dallas, Texas
Member Federal Deposit Insurance Corporation

ter, as may be implied. They ask only that they be permitted to engage in other forms of transportation under the same circumstances as other individuals and corporations . . .

It is further stated that the railroads would be able to compensate for losses in areas of water competition "by excessive rates in other areas." This statement likewise is incorrect. The commission now holds authority to disapprove excessive rail rates and would continue to possess that authority under the legislative proposal of the railroads.

R. G. Rydin
Vice President
Atchison, Topeka & Santa Fe Railway
Chicago.

Editor's note: Lack of space prevented giving all details of the railroad's proposals. The fact remains: The carriers want greater freedom to set rates and compete with other forms of transportation. That they want to do this without infringing on the safeguards of the Interstate Commerce Act goes without saying.

CALENDAR

MAY

6-7 Pacific Coast Gas Association, gas supply and transmission conference, Town and Country Hotel, San Diego, Calif.

7-9 American Petroleum Institute, Division of Production, eastern district meeting, Deshler-Hilton Hotel, Columbus, Ohio.

8-9 Texas Petroleum Research Committee, eleventh oil recovery conference, symposium on "A Century of Texas Oil, 1875-1975," University of Texas, Austin.

9 American Institute of Chemical Engineers, symposium on instrumentation for the chemical engineer, sponsored by Akron, Central Ohio, Cleveland, Detroit, Ohio Valley, Pittsburgh, and Toledo chapters, Commodore Perry Hotel, Toledo.

11-14 Texas Independent Producers and Royalty Owners Association, annual membership meeting, San Antonio, Tex.

12-14 Chemical Institute of Canada, National Research Council, eighth Canadian high polymer forum, Macdonald College, St. Anne de Bellevue, Quebec.

12-14 Instrument Society of America,, symposium of analysis instrumentation division, Shamrock Hilton Hotel, Houston.

12-15 American Petroleum Institute, Division of Refining, midyear meeting, Statler Hotel, Los Angeles.

12-15 American Society of Mechanical Engineers, oil and gas power division conference, Bellevue-Stratford Hotel, Philadelphia.

14-16 McMurry College, second annual conference on oil and gas taxation and estate and gift tax planning, McMurry campus, Abilene, Tex.

DON'T LET THIS HAPPEN TO YOUR TOOL JOINTS

This joint lost money for its owner because it was not properly doped. Properly made-up and lubricated with a WECO Tool Joint Compound zinc-base No-Gall or lead-base Lo-Tork, it would have been a money-maker.

WECO Compounds are made of 50% pure metallic lead or zinc dispersed in a neutral oil with a tacky additive. They always remain soft in the can under all extremes of hot or cold weather and never require thinning.

Low-friction make-up and positive resistance to squeezing out under pressure and high temperature make WECO Tool Joint Compounds perfect for every drilling program.

Add to the life of your drill string connections with WECO Compounds . . . No-Gall for those who prefer zinc base compounds; Lo-Tork for those who want a lead base compound. Your Supply Store carries complete stocks of both.

C-1-58

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HOUSTON, TEXAS

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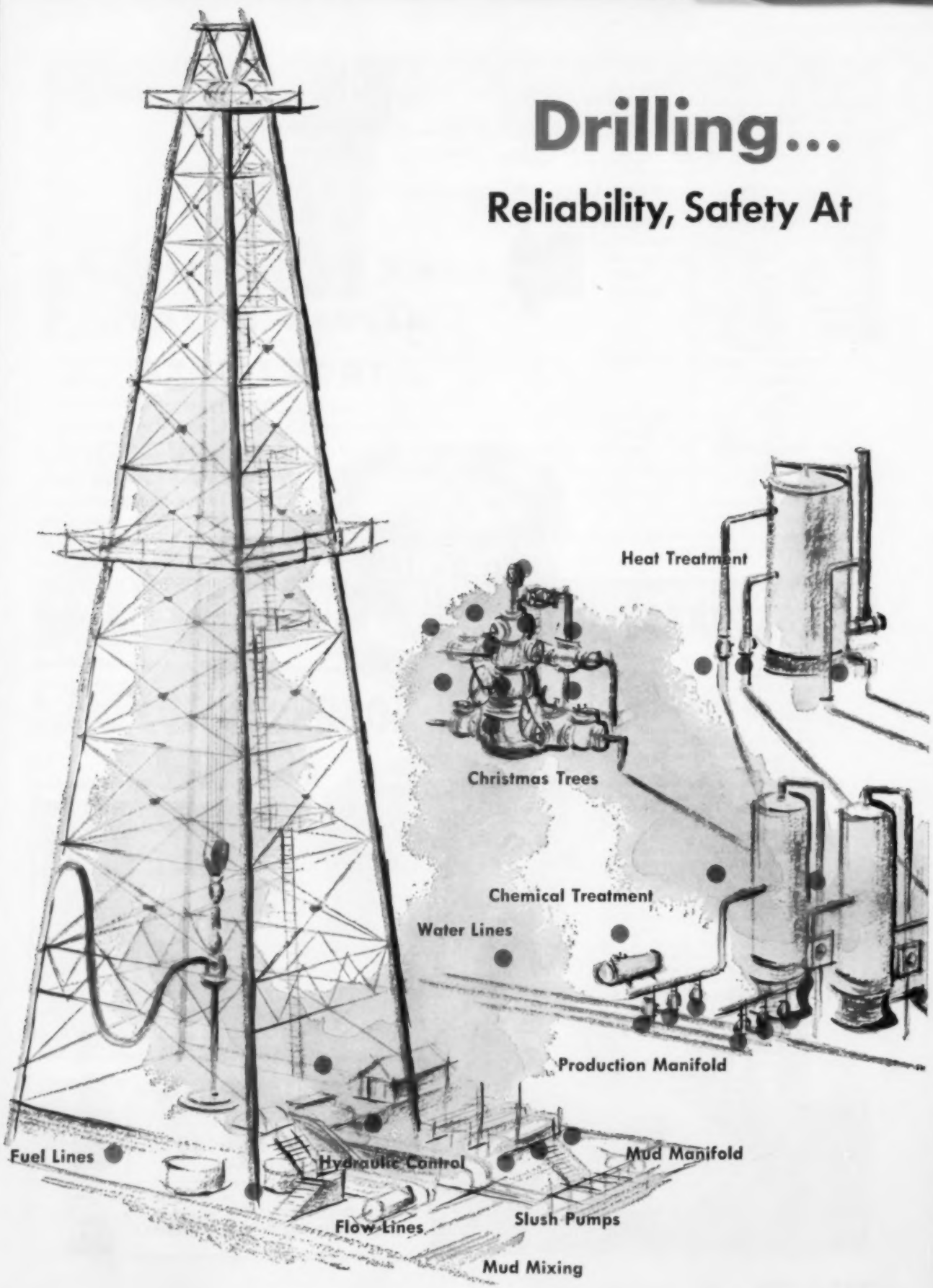
Drilling...

Reliability, Safety At



Completion...Production

Every Step With ROCKWELL-Nordstrom VALVES

Field men depend on Rockwell-Nordstrom valves for reliable, safe flow control. They know that Rockwell-Nordstrom exclusive Sealdport* lubrication assures leakproof, positive shut-off and instant, quarter-turn operation that can't be had in ordinary valves.

The dependability of Rockwell-Nordstrom valves has been proved by forty years of service throughout the oil and gas industries. They can't be matched from any standpoint, yet they cost no more to buy, often less than ordinary valves. For more information, call your supplier or write: Rockwell Manufacturing Company, Pittsburgh 8, Pa.

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*Registered trademark Rockwell Manufacturing Company

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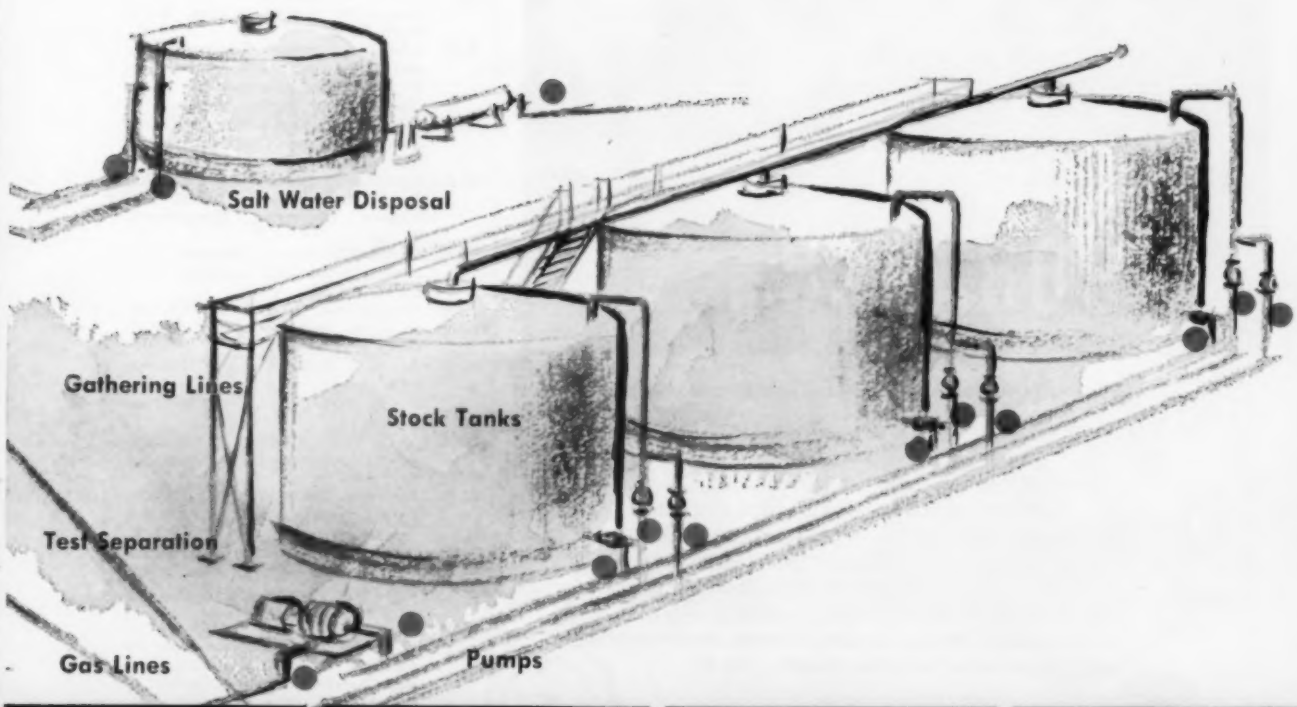
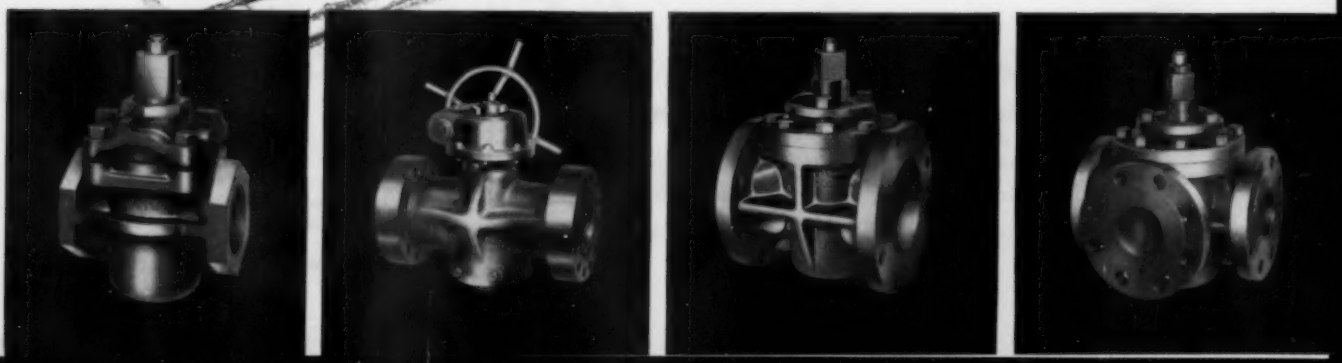
it's ROCKWELL

MANUFACTURING COMPANY





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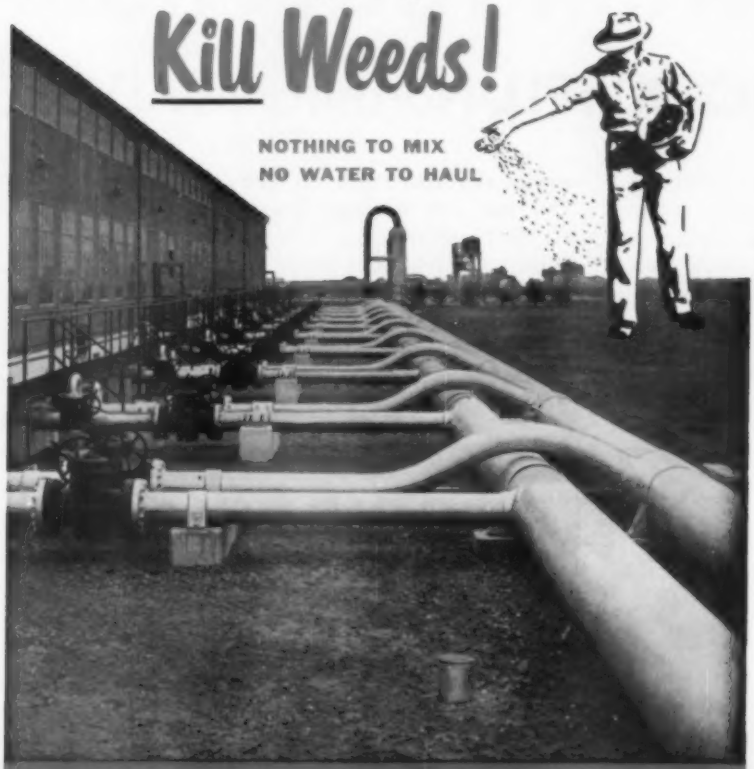
Kill Weeds!

NOTHING TO MIX
NO WATER TO HAUL



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BORASCU® WEED KILLER

.....prevents regrowth—one application may keep area clear of weeds and grasses for 1 or 2 years!

This weed killer gives lasting control of fire-hazardous vegetation... and that's what you need in the Petroleum Industry. Low cost, easy application, safety and convenient packaging are other important features you get with Concentrated BORASCU. Use it anywhere, in any climate, to destroy weeds. Concentrated BORASCU is nonpoisonous, nonflammable, and noncorrosive to ferrous metals... try it!

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20-22	Pennsylvania Gas Association, annual meeting, Pocono Manor Inn, Pocono Manor, Pa.
21-22	Western Petroleum Refiners Association, Southwest regional technical-industrial relations meeting, Hotel Paso del Norte, El Paso, Tex.
21-23	Rocky Mountain Oil and Gas Association, thirteenth annual convention, Cosmopolitan Hotel, Denver.
21-23	American Petroleum Institute, Division of Marketing, midyear meeting, Roosevelt Hotel, New Orleans.
22-23	American Petroleum Institute, Division of Production, Pacific Coast district meeting, Biltmore Hotel, Los Angeles.
26-28	Chemical Institute of Canada, annual conference and exhibition, Royal York Hotel, Toronto.
27-29	Annual Short Course in Gas Technology, Texas College of Arts and Industries, Kingsville, Tex.
28-29	Rocky Mountain Oil and Gas Association, refining committee annual meeting, Cody, Wyo.

JUNE

2-4	University of Texas, short course and conference on automation and computers, University of Texas campus, Austin.
2-4	Petroleum Electric Power Association annual meeting Texas Hotel, Fort Worth.
4-6	National Association of Corrosion Engineers, Southwestern Louisiana Institute, second annual corrosion short course, Lafayette, La.
5-7	National Oil Scouts and Landmen's Association, annual meeting, Mayo Hotel, Tulsa.
8-11	American Petroleum Institute, Division of Transportation, annual tanker conference, Greenbrier Hotel, White Sulphur Springs, W. Va.
8-13	Society of Automotive Engineers, summer meeting, Chalfonte-Haddon Hall, Atlantic City, N. J.
10-12	Appalachian Underground Corrosion Short Course, School of Mines, West Virginia University, Morgantown, W. Va.
15-19	American Society of Mechanical Engineers, semiannual meeting, Hotel Statler Detroit.
19	Pennsylvania Grade Crude Oil Association, annual meeting, Penhills Club, Bradford, Pa.
22-27	American Society for Testing Materials, annual meeting and exhibit, Hotels Statler and Sheraton-Plaza, Boston.
23-25	Interstate Oil Compact Commission, midyear meeting, Hotel Utah, Salt Lake City.
24-27	Canadian Gas Association, fifty-first annual meeting, Manoir Richelieu, Quebec.
25-26	Western Petroleum Refiners Association, Mid-Continent regional technical-industrial relations meeting, Broadview Hotel, Wichita.
28-July 2	Petroleum Equipment Suppliers Association, twenty-third annual meeting, Chateau Frontenac, Quebec.

JULY

23-26	Wyoming Geological Society, thirteenth annual field conference, Powder River basin.

AUGUST

11-14	Society of Automotive Engineers, National West Coast meeting, The Ambassador, Los Angeles.
25-27	Appalachian Gas Measurement Short Course, University of West Virginia, Morgantown, W. Va.

THE NEW 200 *mile-per-hour*
BEECHCRAFT TRAVEL AIR

the QUIETEST
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So quiet you won't believe it... so vibration-free it's like sitting in your own office... so luxurious, so smooth, so much more for your money... that's the All-New Beechcraft Travel Air for 1958. A demonstration ride will prove that this is the truly outstanding airplane in the light twin field!

A quarter century of experience has gone into the New 1958 Travel Air. Its rugged and right design assures maximum performance and durability. But with rugged construction also comes the beauty and distinctiveness of superior styling.

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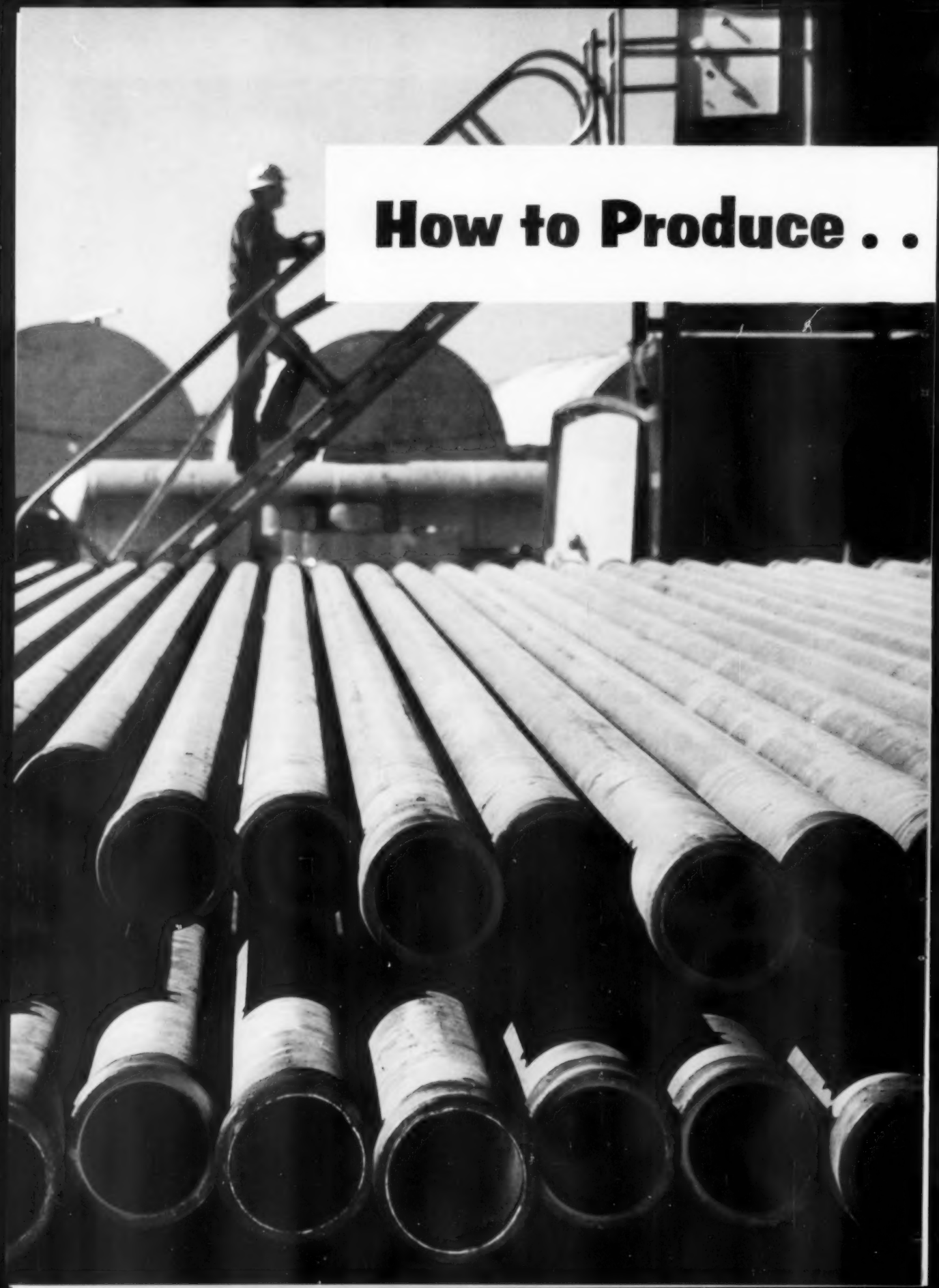

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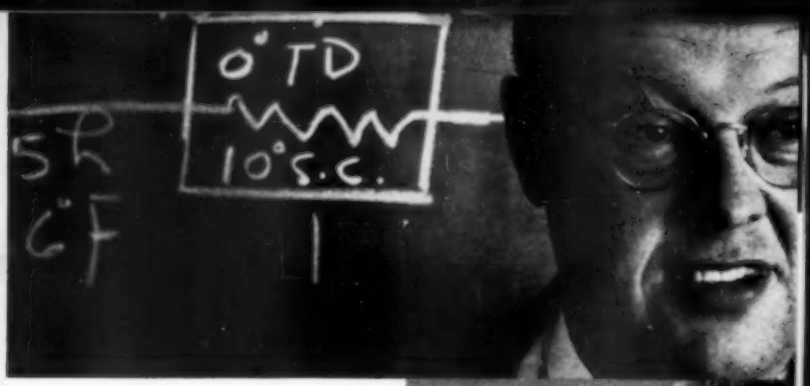

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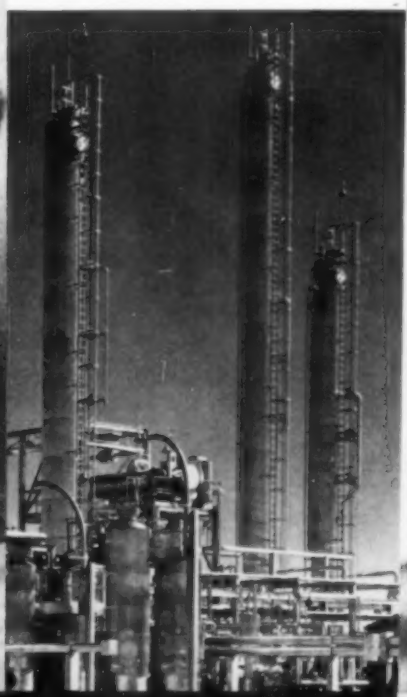

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JOURNALLY SPEAKING

Oklahoma Crime

OUR HISTORICAL note, "Pipeline Crime," in the April 7 issue related early-day methods of stealing gasoline in Oklahoma by boring holes in pipelines. We intimated that the practice has long since been a thing of the past.

Now comes an operator who says that the methods may have changed but the practice is still common, and it is just as difficult to bring the miscreants to justice as it was back in the state's pioneer days.

"Over the past 4 years," he writes, "our company has drilled a number of deep wells in western Oklahoma that produce high-pressure gas and condensate. The condensate is separated and stored on the lease.

"Almost from initial production the condensate has been stolen from the storage tanks. Locks and other devices are unavailing to stop the thieving. Our total losses run at least 2,000 gal. per month, and more during the summer. Some of the thieves even use tank trucks.

"The Oklahoma Tax Commission has agents active in the area. The agents have no authority to bring criminal prosecution, their only function being to collect the state tax on any condensate that has been stolen and improperly transported. These agents have been most cooperative with us in informing us of apprehensions made of thieves on our leases or of confessions obtained from thieves who admitted taking from our premises.

"They are forbidden, however, to sign any criminal information against parties so apprehended.

"The tax agents also have turned the information over to the county attorney's office, but he has refused to take action against any of the parties apprehended by the tax agents.

"We finally did convince him that he should prosecute one individual who was caught on one of our leases. He tried the thief on a misdemeanor charge, whereas the crime is a felony by statute in Oklahoma, and the accused pleaded guilty and was given a suspended sentence.

"In no other case would the county attorney prosecute although the tax agents had furnished him with written confessions.

"The people whom the tax agents have apprehended have in many instances, been reputable citizens in the community. To them the stealing of condensate is no crime at all and they become very indignant at the prospect of being prosecuted as a criminal. The county sheriff will do absolutely nothing toward the apprehension or prosecution of the thieves.

"Our activities in Oklahoma are relatively recent and we are appalled by this apparent breakdown of law and order. I realize that there is little you can do about it, but I do want you to know that the subject of your article is not entirely historical."

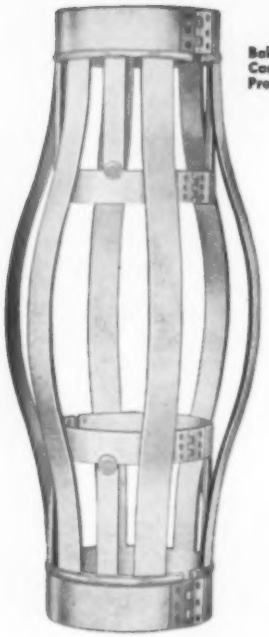
The writer of that letter didn't need to state that he has not operated in Oklahoma long. The old-timers here aren't appalled by the breakdown of law and order. They just accept it as part of the system.

We have a very informal and folksy form of government here, and a very accommodating bunch of state officials. The theory is that if a law is unpopular and irritating, the best thing to do is to do nothing. That way you don't step on any toes. It's better to put up with a slight general annoyance at lax enforcement than to make some reputable citizens appear less reputable by publicly calling attention to their indiscretions.

At least that seems to be the prevailing attitude toward a provision of the Oklahoma Constitution which purports to ban indulgence in a certain type of beverage. Some of our most reputable citizens wink at that law frequently, and the sheriffs and county attorneys always seem to be looking the other way. It's what's known in these parts as popular government.

Too bad for the writer of that letter that he happens to operate in an area where bootlegging gasoline is viewed in the same light as bootlegging certain other liquids. But he's operating in Oklahoma "where the sunshine is the grandest and the politics is the dangdest."

—Henry D. Ralph.



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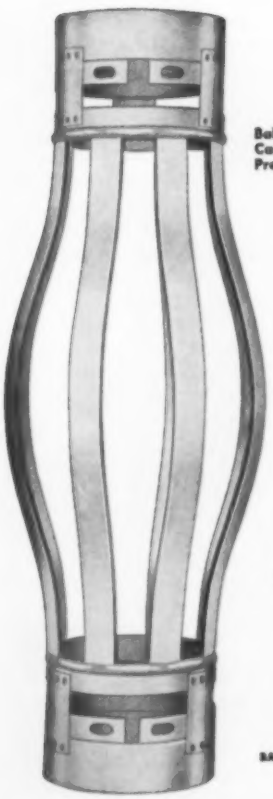

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The Ikard bill leaves too many questions unanswered

WORD from Washington is that Congress may not include any specific petroleum provisions in the Reciprocal Trade Act.

Instead it may simply give the President a little firmer directive to prevent excessive importation of commodities vital to the national security.

If this is so, the Ikard bill is dead and there is little point in discussing details of how it might operate.

THIS IS JUST AS WELL. The Ikard bill proposes to sell import licenses to the highest bidder. This is an intriguing idea for dividing up the over-all quota. At first blush it appears to accomplish this by competition in the market place rather than by government control.

But the Ikard plan does not stand up under close examination. This became apparent at the IPAA meeting in Chicago last week, where it was the chief topic of discussion in meeting rooms and corridors.

A great many individual IPAA members went to Chicago with doubts and criticisms of certain provisions, and full of questions as to how the plan might operate under various sorts of conditions. They got few questions answered, few doubts allayed.

It soon became obvious that the majority of those strongly backing the Ikard bill are really interested in just one of its provisions—legislative limitation of imports of both crude and products to their 1954 ratio to domestic crude production. A minority are additionally eager to penalize importers by a tariff disguised as a license bid.

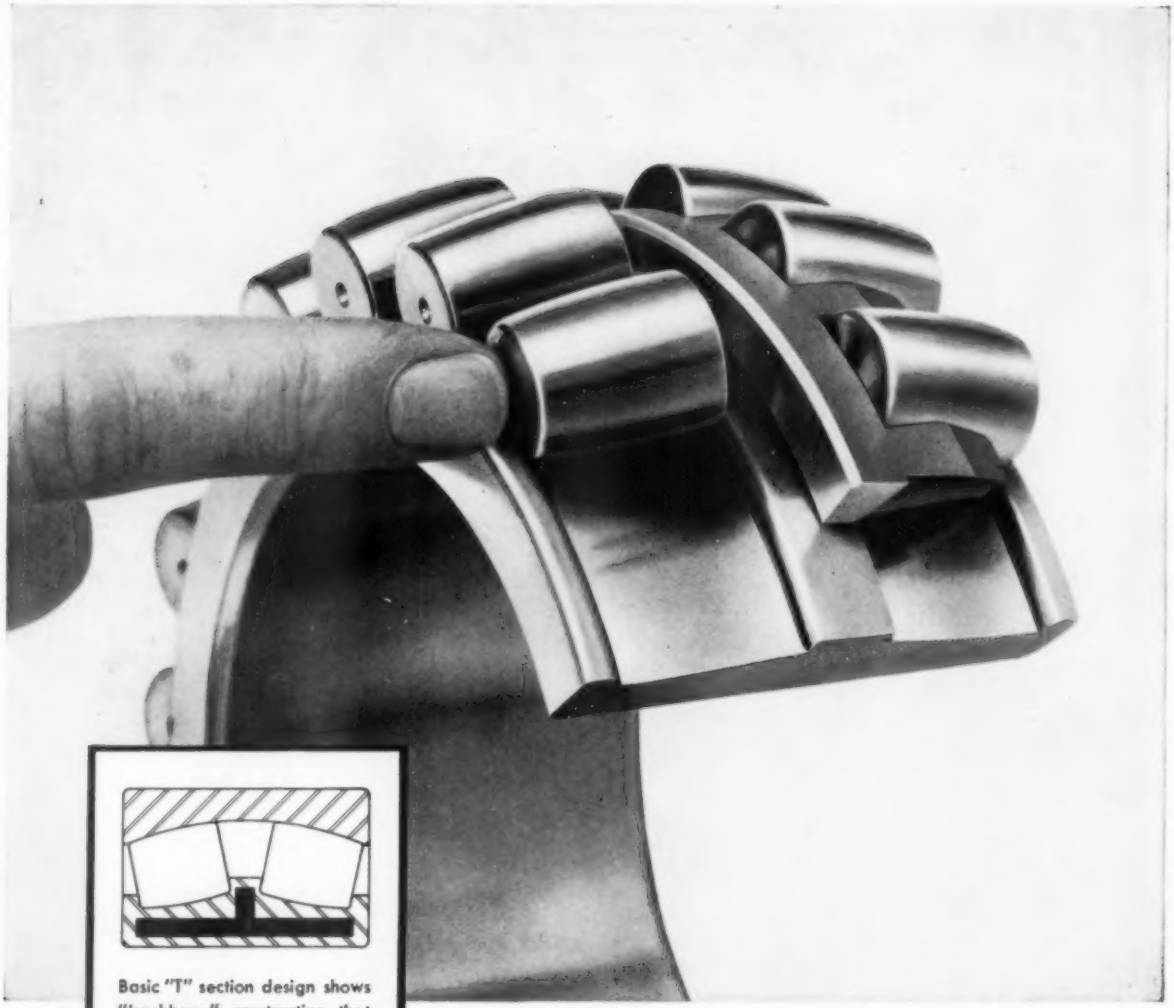
None of the bill's ramrodders cared to discuss such details as how the bidding plan might affect, for example, a particular foreign nation, or an American company with production abroad, or a historic importer, or a new importer, or a jobber of imported fuel oil—or oil consumers.

All doubts and questions were passed over with the statement that perfecting amendments might be considered at some later date, or that the President would have discretion to set up regulations to insure that the plan functions with justice and equity to all.

THIS LEAVES THE IKARD BILL a pig in a poke. It puts it in the light of a hasty improvisation that needs a lot more study before it can be advanced as an equitable and workable plan.

People complain that the administration's present method of limiting imports is uncertain, full of bugs, and a step toward federal regulation. There is no proof that the Ikard plan would be less so.

A fair and workable plan to regulate oil imports is certainly needed. But it would be dangerous to write into law an untried mechanism that might create more troubles than it would cure.



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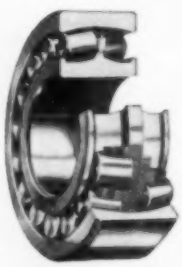

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Floods Seen As Solution in Spraberry

• New life will be breathed into this giant West Texas field by seven floods expected to get under way during the next 2 years. Recovery won't be as big as in some areas, but the floods should make Spraberry a paying proposition.

Robert J. Enright
Dallas District Editor

WATER-FLOOD FEVER is sweeping the Spraberry area these days.

It now has affected every major acreage holder in the sprawling 350,000-acre West Texas field.

Virtually the entire Spraberry Trend Area is pulsing with an eagerness to unitize. The result: Seven major units taking in 250,000 acres or more are in the works.

The new units are in various preliminary stages. But it is almost certain that at least six of them—the largest—will be pushed successfully through the tedious red tape. They should be injecting water within 2 years.

Reason for the swing to flooding is clear: Pilot tests indicate operators can double or triple their primary production by injecting water. For some, it could mean the difference between big loss or profit on their Spraberry operations.

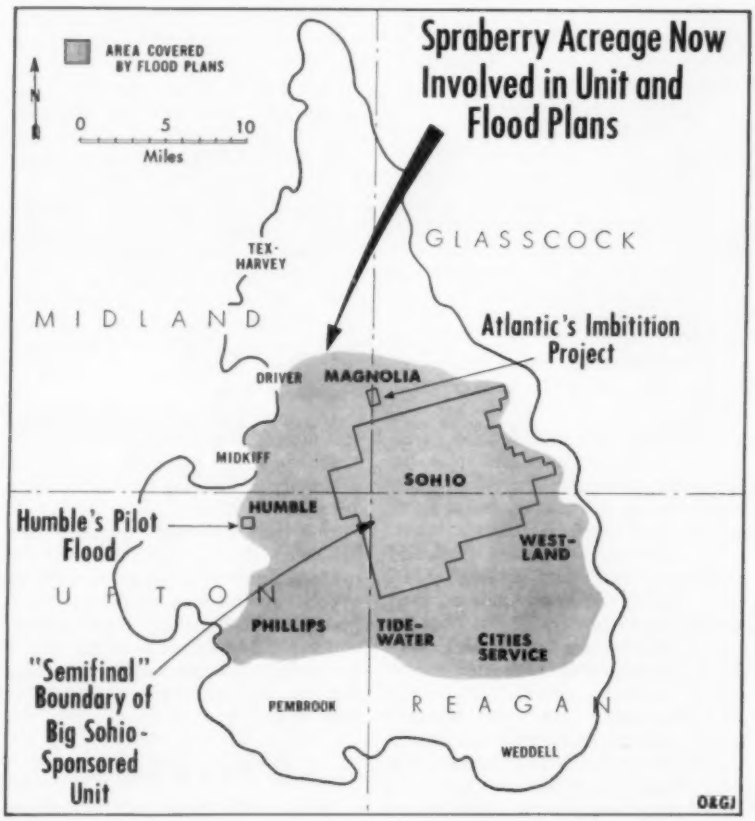
Here are the calculations under:

... Primary recovery. Operators generally agree recovery from the upper Spraberry—the main zone—will average only about 400 to 500 bbl. an acre. Where the lower Spraberry is present, combined primary take from both zones should average about 700 bbl. an acre.

This is a poor showing—the 400-500 bbl. an acre coming to only about 6 to 8% of the oil initially in place.

... Flood recovery. The prospects here are much brighter. Water-flood oil, even by conservative estimates, should average from 800 to 1,500 bbl. an acre from the upper zone alone.

A fortunate few in the big field just recently have emerged from the red in their Spraberry operations. This largely was due to their getting in early, having lower Spraberry pay, and then capitalizing in an unexpected way from production from the shallower Spraberry Clear Fork (OGJ, Sept. 2, 1957, p. 90).



Others not benefiting from these assists, however, still are facing Spraberry losses.

Spraberry floods, if successful on the predicted scale, likely would boost most of the present losers over into the profit column.

I. The Line-Up

Sohio Petroleum Co. is leading the way in the push to unitize and flood the Spraberry.

The Sohio-sponsored unit, now well advanced, likely will develop into the world's largest unitized flood (OGJ, Oct. 7, 1957, p. 98). Indications are that this unit will take in between 55,000 and 64,000 acres (85 to 100 sections). The unit would surround Sohio's big acreage blocks in the Driver area in the east central part of the field. This would rank it in size well above the present largest unit, SACROC, the 50,000-acre operation in Kelly-Snyder field.

Sohio and most other operators in

this area now have agreed on such ticklish questions as basis for participation. And it appears a working unit is not far off.

It's likely that the other prospective units, not yet so far along, will largely adopt the basic agreements thrashed out by the Sohio group. Thus, the others should progress faster.

Six other units (see map) are now also taking shape. Five of these will center around the large acreage blocks of other major companies in the field. Unit sizes will range from about 30 to 50 sections.

Here's the rundown:

. . . **Magnolia Petroleum Co.** to the north is quietly pushing plans for a unit which would adjoin the Sohio unit north boundary and extend north to the point where quality of the lower Spraberry zone deteriorates. Magnolia later may form a second unit farther north.

. . . **Humble Oil & Refining Co.** and Sinclair Oil & Gas Co. are throwing in together on a big unit centered in the Midkiff area to the west of Sohio. This one would extend east to the west lines of the Sohio and Magnolia units.

Humble will be the operator and already has preliminary moves well organized. The first operators' meeting was held April 22. The operators quickly formed an engineering committee, and this group held its first meeting April 28.

. . . **Phillips Petroleum Co.** and Amerada Petroleum Corp. plan to pool their acreage in the North Pembrook-Weiner Floyd area. It lies south of the Humble-Sinclair unit.

. . . **Tidewater Oil Co.** will attempt to form a fourth unit in the Aldwell area east of Phillips-Amerada and southwest of Sohio.

. . . **Cities Service Oil Co.** will sponsor a unit adjoining Tidewater on the east in the same region.

. . . **Westland** Oil Development Corp. plans a unit on the extreme east side of the field southeast of the Sohio unit. This project likely will take in 10 to 20 sections. If their plans do not materialize, the acreage probably will be absorbed by one of the larger operations.

Blanket of water . . . The seven proposed units would blanket the bulky central part of Spraberry.

Only the extremities would be left unflooded.

Left out so far, are the old Tex Harvey and Germania areas to the north and the southern Pembrook and the Weddell regions to the south.

The Tex Harvey-Germania region is the field's oldest. A large number of its wells already have been plugged after reaching the economic limit. And this would pose extra difficulties and expense in setting up a flood—something the Spraberry operators are anxious to avoid.

The Pembrook and Weddell wells, on the other hand, are among the field's newest and the pressure in these areas for speedy unitization is not so great.

Sohio on the move . . . Sohio and its neighbor operators are under pressure in the Driver area to get a flood going before many more wells become economic liabilities and have to be plugged.

When Sohio launched its unit drive by holding first operators' meetings last October, it estimated the flood would have to be under way within a year or too many wells would have been abandoned.

Operator and engineering committees have held meetings regularly since. Progress has been steady, but slow. Fixing unit bounds has been difficult. Each time a tentative line was drawn, operators outside it clamored to be admitted.

Likewise, settling on a basis for unit participation in production was tough. Sohio initially proposed an acreage base with each two-zone acre (with both upper and lower Spraberry production) valued at 1.5 times a single-zone acre.

This now has been dropped in favor of simple straight acreage allocation. The change was made due to the impossibility of defining the limits of the lower Spraberry.

A "semifinal" unit boundary now has been drawn, however. And an overwhelming percentage of working interests have approved the participation formula. Prospects are that Sohio will be in a position to go to Austin for approval of the unit by the Texas Railroad Commission well before its year is up.

II. How It Started

What really kicked off the waterflood boom in Spraberry was Humble's successful pilot flood on the western side of the field.

This 80-acre, five-spot test in the upper Spraberry recovered more than 1,500 bbl. of extra oil per acre before being abandoned last month as having served out its purpose.

Prior to this, most operators in the field felt flooding would not recover enough added oil to make it worthwhile.

Results of the Humble test changed this thinking in a hurry.

Humble in its pilot flood took up where an earlier Spraberry flooding pioneer, Atlantic Refining Co., left off.

Atlantic proved that the unusually tight, fractured pay could be flooded with its imbibition field test started in 1952. But production rates were too low to interest other operators.

Key to success . . . Humble went one step further.

It found that, along with imbibition, the Spraberry's billions of small cross fractures (as opposed to the main northeast-southwest fracture pattern) were a big aid to flooding.

The cross fractures provided entry points for flow into the matrix. Under flow conditions, pressure gradients exist across all fractured blocks. And flow will occur in these fractures with significantly short flood-out times.

Water enters the water-wet matrix from the cross fractures continuously and continuously forces oil out into the main fracture system.

Humble found that injection rates could be much higher than formerly thought possible. Injection rates at the Humble pilot ran three times higher than at the Atlantic flood.

Sohio's conclusions . . . Engineers for Sohio, given access to data from both the Atlantic and Humble projects, made one big deduction.

They decided the high input rate at the Humble pilot was the only major difference between the two tests and this must be the key to Humble's high oil-producing rate.

Sohio reasoned further that the big factor behind the rapid decline in Spraberry production was not lack of oil but sand compaction and closing of fractures as pore space was voided and pressure dropped.

High water-input rates, Sohio thought, restored reservoir pressure in the Humble pilot area and reopened the all-important fractures. The company contended that the history of large fracture treatments in the Spraberry bears out this theory. These fractures often doubled or tripled a wells production. But their effects were short-lived because the fractures soon closed again.

III. The Flooding Formula

The upcoming Spraberry floods, as planned by Sohio and other projected unit operators, generally will look like this:

. . . **The typical flood pattern** will be a 320-acre, five spot—one well (alternately producers and inputs) on each quarter section.

. . . **Closer spaced wells** (than 160 acres) will mostly be recompleted in the San Andres as water-supply wells.

In a 1-day test of this zone, a Sohio well produced 12,000 bbl. of water daily with a pressure drawdown of only 45 psi.

... **Pilot floods** will be conducted by each unit prior to full-scale operation to prove economics.

... **High water-input rates** will be adopted to pump Spraberry reservoir pressure back up 2,000 psi. or higher to reopen and keep open the fractures.

... **Little drilling** will be done to keep flooding expenses to a minimum.

Along with its internal problems, each unit will be working with each adjoining unit to coordinate injection operations along common boundaries.

This will involve considerable effort from both administrative and engineering standpoints.

IV. The Economics

Spraberry operators for the most part all have similar thoughts about flooding in the Spraberry. They think the Spraberry could never be classed as a top-notch water-flooding prospect. It is looked upon more as a salvage proposition.

Nevertheless, they wouldn't be jumping into these projects if they didn't envision substantial profit.

Sohio, for instance, has figured finances backwards and forward and feels Spraberry flood profits could run as high as $20 for each $1 invested.

This assumed recoveries comparable to that achieved by the Humble pilot at daily production rates of 50-200 bbl., water-supply and distribution costs of about $135,500 per section, use of 160-acre well spacing with 320-acre five spots, and no added drilling.

The profit estimate was before income taxes and discount but after deducting for royalty and state production tax payments.

Such a flood, Sohio now thinks, would pay out in only 1½ to 4 years. Project life would be from 15 to 40 years.

Even if flood recovery should amount to only 500 bbl. per acre, Sohio says profit still would be satisfactory. With the same daily production, payout in this instance would be the same, but field life would be cut to 7 to 13 years.

On the brighter side, should flood recoveries reach 1,500 bbl. an acre —and this isn't even spectacular in good flooding country—the profit potential would be terrific.

From just the 250,000-plus acres now involved in unit plans, the gain would be 375,000,000 bbl. of extra oil from the upper Spraberry alone.

That's enough oil to give any operator the flood fever.

WORLD'S DEEPEST whipstock hole takes Texas title as . . .

Wildcat Nears Record Depth

PHILLIPS PETROLEUM Co. last week wiped out what appeared to be a formidable Texas deep-drilling record when it was set by Pan American Petroleum Corp. only last year.

Phillips' 1-EE University in Pecos County, West Texas, cracked this 21,687-ft. mark April 28 and by April 30 was drilling ahead at 21,735 ft. in Ellenburger lime.

At that depth the deep test was only 832 ft. short of the world depth record of 22,570 ft. chalked up in South Louisiana in 1955 by Richardson & Bass and others.

The 1-EE University is 9 miles southwest of Baldridge and only 7 miles northwest of Pan Am's displaced title holder, the 1-CS University.

The Phillips test is drilling on a contract amended to 23,000 ft. Its objective is the Ellenburger, which it topped for the second time at 21,606 ft. after passing through a thrust fault at about 20,520 ft.

Because of the overthrust, both the Ellenburger and the shallower Simpson were previously encountered up the hole. The wildcat first topped the Simpson at 13,425 ft., the Ellenburger at 16,708 ft. Then it passed through the fault at 20,250 ft. and reentered the Simpson.

World record? . . . Whether the Phillips test will topple the world drilling mark probably will depend to a great extent on thickness of the Ellenburger and the trouble or lack of trouble the well encounters.

Trouble up the hole was responsible for the 1-EE University's assuming an unwanted world title already. A parted drill stem at 21,396 ft. proved unrecoverable and forced the operator last February to back up the hole to 19,986 ft. to carry out the world's deepest whipstock operation. Drilling since has been in the sidetracked hole.

Phillips is sole operator of the wildcat. Drilling has been under way since October 1956. The test, located on a 9,000-acre lease block, first was projected to 18,500 ft. This was later amended to 21,000 ft., then to 23,000 ft.

Even if the Ellenburger proves dry, the well may be a discovery. Commercial oil shows were indicated in the Wolfcamp topped at 8,600 ft.

IPAA Revises Supply-Demand Forecast Downward

(Thousands of barrels daily, except stocks)

	1st Q. 1958	2nd Q. 1958	3rd Q. 1958	4th Q. 1958	Year 1958	1st Q. 1959
Domestic demand	**9,677**	**8,315**	**8,350**	**9,450**	**8,948**	**9,940**
Gasoline	3,490	4,060	4,100	3,820	3,868	3,640
Kerosine	500	160	180	400	310	470
Distillate	2,533	1,250	1,140	2,090	1,753	2,610
Residual	1,674	1,280	1,170	1,530	1,413	1,680
Other	1,480	1,565	1,760	1,610	1,604	1,540
Exports	**251**	**270**	**270**	**270**	**265**	**270**
Gasoline	68	70	75	70	71	70
Kerosine	4	5	5	5	5	5
Distillate	60	65	60	65	62	65
Residual	58	60	60	60	60	60
Other	61	70	70	70	67	70
Total demand	**9,928**	**8,585**	**8,620**	**9,720**	**9,213**	**10,210**
Stock change	**—814**	**22**	**500**	**—250**	**—133**	**—622**
Crude		—187			— 47	
Products	—814	209	500	—250	— 86	—622
New supply	**9,114**	**8,607**	**9,120**	**9,470**	**9,080**	**9,588**
Imports						
Crude	(†)	(*)	(*)	(*)	(*)	(*)
Products	(†)	(†)	(†)	(†)	(†)	(†)
Production						
Crude	(†)	*6,411	*6,975	*7,125	(*)	*7,185
Natural, etc.	(†)	(†)	(†)	(†)	(†)	(†)
Runs to stills	**7,511**	**7,436**	**7,791**	**7,948**	**7,677**	**8,014**
Closing stocks‡	**768**	**770**	**816**	**793**	**793**	**737**
Gasoline	215	185	170	183	183	205
Kerosine	17	27	35	29	29	18
Distillate	75	109	157	136	136	75
Residual	55	59	67	61	61	55
Other products	124	125	122	119	119	119
Crude	282	265	265	265	265	265

*Production based on assumption that crude imports will approximate the level established under the voluntary oil import plan. †No data released. ‡Millions of barrels.

Demand Lower Than Expected

DOMESTIC DEMAND for petroleum products will average 8,948,000 bbl. daily for 1958 for an increase of 1.5% over 1957. This compares with an average annual increase for the 5-year period 1952-57 of 4%.

Exports for 1958 will be off about 50% from the 1957 level, resulting in a decrease in total demand of 1.8%.

These are the revised estimates for the year released by the supply and demand committee of the Independent Petroleum Association of America.

The new projection of domestic demand is 270,000 bbl. daily less than the committee's original estimate, made at the end of October last year. Gasoline and residual fuel accounted for most of the revision.

The forecast of domestic demand for gasoline was lowered 120,000 bbl. daily, and residual was dropped 106,000 bbl. daily. Middle distillate was cut back 44,000 bbl. daily, made up from a small increase of 9,000 bbl. daily for kerosine and a reduction of 53,000 bbl. daily for distillate.

The committee now expects total exports to average 265,000 bbl. daily, off 68,000 bbl. daily from the earlier forecast. This adjustment results in a total demand estimate that is 338,000 bbl. daily lower than the total expected last fall.

Stock change . . . The current outlook is for supplying 133,000 bbl. daily of this demand out of accumulated inventories, in contrast with a stock increase of 8,000 bbl. daily expected at the time the earlier forecast was made.

This revision in stock changes, amounting to 141,000 bbl. daily, combined with the downward adjustment in the total demand estimate, accounts for the 479,000-bbl.-daily drop in required new supply.

The committee does not forecast crude production. However, it did estimate that domestic crude production would average 6,693,000 bbl. daily during the summer quarters and 7,156,000 bbl. daily next winter if crude imports remain at the level established by the voluntary oil import program.

Fourth-quarter upturn . . . The demand forecast was based on a general economic projection through the remainder of this year.

The committee's estimates of gross national product and industrial production indicate the present recession will continue, with a moderate upturn in the fourth quarter.

Alberta Crude Slips

again in May. Cuts by U. S. refiners offset other gains.

DEMAND for Alberta crude oil will continue at its lowest ebb in 3 years.

May nominations submitted to the Alberta Oil and Gas Conservation Board total only 266,505 bbl. daily, 5,443 bbl. daily below the April figure. Demand hasn't been this low since April 1955, when daily average was 243,985 bbl.

Further cuts by United States refiners more than offset slight increases in demand from British Columbia, Manitoba, and Ontario.

Only five U. S. refiners placed nominations for May. They will take a total of 28,200 bbl. daily compared with 40,420 bbl. per day in April. Nominations are:

General Petroleum Corp., Ferndale, Wash., 11,500 bbl. daily; Shell Oil Co., Anacortes, Wash., 9,800 bbl.; International Refineries, Inc., Wrenshall, Minn., 5,800; Bay Refining Corp., Bay City, Mich., 1,000; and Union Oil Co. of California, Cut Bank, Mont., 100.

Jayhawk Awards Contracts

WORK WILL BEGIN this week on Jayhawk Pipe Line Co.'s 242-mile crude line from Meade in southwestern Kansas to the McPherson and Wichita refining areas.

Contracts for the $8,650,000 project were awarded to R. H. Fulton & Co., Lubbock, Tex. Jayhawk says the new 10 and 12-in. line will save producers 75 cents a barrel in trucking costs when the project is completed September 1.

The line will serve 20 Kansas fields which have been shut in or served by truck transportation for the past year. Any Oklahoma crude transported by

the line will have to be trucked to a Kansas receiving station. Initial capacity, with electric-driven centrifugal pump stations at Meade and Chase, will be 26,000 bbl. daily.

Derby Refining Co., subsidiary of Colorado Oil & Gas Corp., will take 3,000 to 5,000 bbl. daily of the initial throughput at Wichita, and National Cooperative Refinery Association will take the rest at McPherson. Colorado and NCRA are joint owners of the project.

Kellogg Diversifies

to spread refining know-how to other process industries.

KNOW-HOW in turnkey construction of oil refineries is now spreading out to other industries. The M. W. Kellogg Co., with roots deep in oil, believes it can give smaller process industries a shot in the arm on capital-investment plans.

While retaining a strong interest in petroleum and petrochemicals, the company feels it can broaden its field and stimulate recession recovery by offering processors across the board more for their money earmarked for new plants.

Kellogg backs up this reasoning in offering to take on full responsibility for design, engineering, procurement, and construction—anywhere in the free world. Since each of these aspects bears on the others in expediting a complete job, the company believes its integrated know-how developed in building refineries can raise plant productivity in many new fields.

Cost cutting . . . Two examples of cost cutting for clients are cited by J. M. McAneny, director of industrial projects.

A growing computer center at Kellogg's New York headquarters is taking over more work from engineers, freeing them for more constructive work. It is now handling such routine jobs as pipe-stress analysis, heat-exchanger design, and recording and transfer of engineering data.

On another front, plant models are promoting greater efficiency. Kellogg uses these functional models in initial design and plant layout. Their use is extended in reducing the need for many drawings and finally to the training of operators prior to plant startup.

The first Kellogg move into other fields came in the form of a contract to handle all details on a new copper refinery for Kennecott Copper Corp., at Baltimore.

watching WASHINGTON

. . . with Bertram F. Linz

• Rackets, rockets, and recession

OIL MEN in Washington are beginning to breathe a little easier. The 1958 session of Congress is half over and the industry hasn't been put on the griddle.

Right now the big issues are recession, labor rackets, and revamping of the military setup.

The only major pending bill involving oil is the Reciprocal Trade Act. And there the question is not what the industry is doing, but whether Congress or the White House shall fix import controls.

So far there has been none of the deep probes of the industry which threatened when Congress met in January. And none appears to be in the making now.

House and Senate commerce committees show no signs of taking up oil or gas matters. But the House group may do so if it ever gets around to the Federal Power Commission in its inquiry into the influences exerted on the federal regulatory agencies.

Some inquiries into the industry may pop up at any time, of course. But it's getting late in the session, the campaigns will soon get started, and people are more interested in jobs and taxes and things like that.

• Gas cuts into oil, coal markets

NATURAL-GAS demand continues to grow while the oil industry marks time.

The spreading use of gas is cutting into the markets for oil as well as coal. How deep these cuts are getting is shown in figures from the Federal Power Commission.

Gas sales of 41 pipelines were more than 100 billion cubic feet greater in February than in the same month last year.

But domestic crude production in February was 847,000 bbl. a day less. That was a total loss of nearly 24 million barrels for the month.

In the 12 months ended with February the pipelines sold 711 billion cubic feet more gas than in the preceding period. And while sales to ultimate consumers increased only 2.8% (they showed a drop in February), sales for resale to the general public increased 11%.

• New antitrust weapon sought

THE JUSTICE DEPARTMENT is trying to level barriers which impede the bringing of civil antitrust cases.

Asst. Atty. Gen. Victor R. Hansen, antitrust division chief, is beating the bushes to get lawyers' support for a bill which, in effect, would make violators help convict themselves.

The bill would allow the department to demand the surrender of records and papers bearing on an antitrust investigation. Severe penalties would be imposed for the removal or destruction of records or other action to avoid compliance.

The department now has no such power. It must seek the voluntary cooperation of firms and persons under investigation, which it doesn't always get. Or it must proceed by way of grand jury, which it doesn't often do in civil cases.

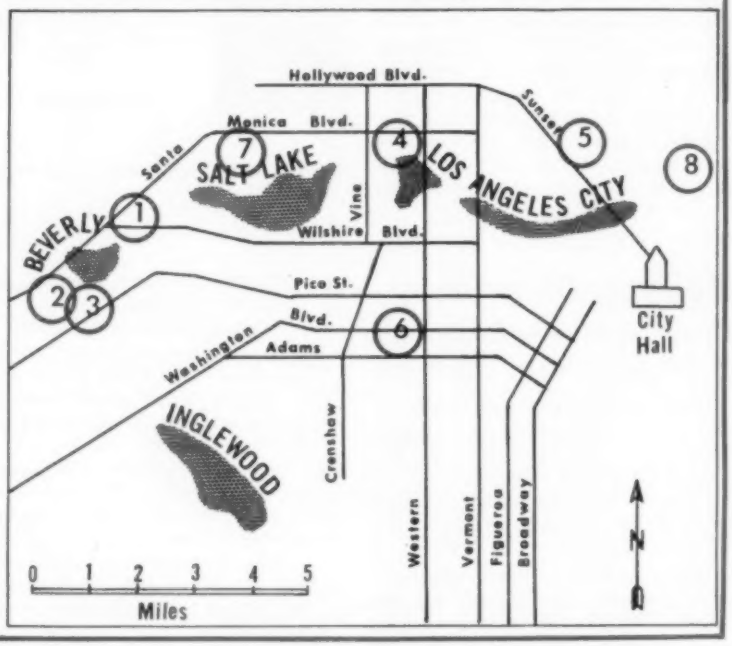
Hansen admits that objections have been raised. One point is that it disregards the separation of the executive and judicial power. Another is that it could be abused by the executive officer.

But Hansen contends that the courts would protect against abuse. And companies which refuse to open their records voluntarily frequently change their mind when a grand jury gets busy.

Drilling Sites in Metropolitan Los Angeles

Company and Location

1. Hudson Gas & Oil, Los Angeles Country Club.
2. Signal Oil & Gas, Hillcrest Country Club.
3. Signal, Rancho Park Golf Course
4. Union Oil, Hollywood.
5. Richfield Oil, Los Angeles Silver Lake District
6. Union, Central Los Angeles.
7. Morgan Brown, Beverly Hills.
8. Tidelands Exploration, Lincoln Heights.



Drillers Moving Back Into Los Angeles

• Old fields in exclusive districts will be tested at greater depths under new rules that require soundproofed rigs, landscaping, and other devices making drilling more palatable to the public. Discovery prospects are good.

OIL DRILLERS will be digging into the golf courses, studio lots, residential areas, and industrial districts of metropolitan Los Angeles before the summer is over.

The search for new oil in the sprawling metropolis has been delayed for more than 30 years in some cases because of the explosive growth of the city since the close of World War I.

But now, with soundproofing, landscaping, and other devices to tidy up their operations, the drillers are being allowed once again to explore a number of most attractive areas in the Los Angeles Basin.

During the years they were excluded, oil companies moved from the close-in fields to the flanks of the metropolitan area to make such tremendous discoveries as Signal Hill, with cumulative production of 805 million barrels, Wilmington, with 800 million barrels, and Santa Fe Springs, with 569 million.

Along with their accumulation of oil, the companies also harvested a crop of bad publicity. Frequent blowouts and fires, unsightly forests of derricks, noises, and smells contributed to the unsightly picture home owners held of the drilling and production phase of the industry.

In recent years, however, many of the barriers to residential drilling have been eliminated. Public acceptance of the driller has increased, and oil companies are getting a second chance.

Some of the areas to be tapped actually were drilled in the past—but only superficially because of primitive techniques used at the time.

Why the interest? . . . All that is needed to whet the appetite of the operator for going back into some of these old metropolitan sections is a brief study of the huge fields bordering the city.

For instance, take the three mentioned earlier:

. . . **Signal Hill** boasts seven producing intervals between 4,404 ft. and 10,046 ft.

. . . **Wilmington** has production in a number of intervals between 2,500 ft. and 6,000 ft.

. . . **Santa Fe Springs** is producing from nine intervals between 3,000 ft. and 10,000-plus ft.

The old areas which oil companies are now reinvading produced from zones rarely exceeding 2,500 ft. deep. If the experience common elsewhere in the basin, where pools are stacked on pools, applies to these older areas, the possibilities are staggering.

Drill sites . . . Within the next 60 days these drilling projects are expected to start.

. . . **Los Angeles Country Club** (No. 1 on map). Hudson Gas & Oil Corp. of Shreveport plans to spud in its first wildcat on a golf course in one of Los Angeles' most exclusive residential areas. The lease is in Beverly Hills and is split by fashionable Wilshire Boulevard.

. . . **Hillcrest Country Club** (No. 2). Signal Oil & Gas Co. has staked location for a wildcat to test adjoining community leases in West Los Angeles as well as the 140-acre golf course itself.

. . . **Rancho Park Golf Course**

(No. 3). Signal also plans to drill this 190-acre links as well as some 400 acres in community leases adjoining it.

... Hollywood (No. 4). Union Oil Co. has a location set for a 5,000-ft. wildcat on the Paramount movie lot in central Hollywood.

... Los Angeles Silverlake District (No. 5). Richfield Oil Corp. recently had a drilling district approved for this medium-priced residential district between Hollywood and downtown Los Angeles. Richfield has a site tentatively plotted on famed Sunset Boulevard, just a few miles west of the City Hall. All told, Richfield has 1,165 acres sewed up in community leases in the play.

... Central Los Angeles (No. 6). Union Oil Co. has a 160-acre drilling district set up in the vicinity of Western Avenue and Washington Boulevard. Drilling plans await city approval.

... Beverly Hills (No. 7). Morgan Brown has a soundproofed derrick set up on a site on West Los Angeles' restaurant row. For more than a year he has been cutting at red tape so that drilling can be resumed. He had about 1,000 ft. of hole made when he was forced to halt operations because of technical difficulties with the city.

... Lincoln Heights (No. 8). Tidelands Exploration Co. recently was granted approval to drill a 43-acre lease it holds in this old residential and industrial part of the city just north of the civic center.

The attraction of each . . . All except one of the planned operations are based on a background of successful oil production in the immediate area which was halted after World War I by rapid residential development.

Rancho and the Hillcrest and Los Angeles country clubs are associated with Universal Consolidated Oil Co.'s successful development of deeper production in the old Beverly Hills field.

In 1954, Universal tapped a deep pool in this oil field from a soundproofed, landscaped drill site on the 20th Century movie lot. The company has 18 wells making around 2,000 bbl. daily under highly restricted chokes from several deep zones.

The field was discovered in July 1900. Production was from the Wolfskill pool at around 3,000 ft. Cumulative production to date is 4.3 million barrels, and there are still two old wells pumping 36 bbl. each from the shallow Wolfskill pool — more than 50 years later.

The Paramount studio site of Union and the Silverlake play of Richfield are associated with the Los Angeles City field and the Salt Lake field.

Salt Lake field, just west of Paramount, was discovered in 1903. At its height in 1908 it produced in 1 year 4½ million barrels from 185 wells. There are still seven wells pumping 7 bbl. each daily from the 2,200-ft. pool. Morgan Brown's Beverly Hills test is north of Salt Lake field.

The Los Angeles City field was discovered in 1890. Most production came from wells less than 1,000 ft. deep. There are still 82 stripper wells pumping a little more than 1 bbl. each per day. Cumulative production is in excess of 20 million barrels. Tidelands' Lincoln Heights play is on the east flank of Los Angeles City field.

Union Oil's central Los Angeles lease is on the only undrilled high in the metropolitan area of the city. This is an area that developed residentially before the drillers ever had a shot at it.

The rules . . . All operations will be conducted under stringent housekeeping rules.

Derricks must be completely soundproofed, and designed and painted to blend in with the surroundings. This adds more than $10,000 to the cost of each well.

Trucking operations can be carried on only during specified daylight hours. The driller must anticipate his drill pipe needs and have the pipe inside the derrick before a certain hour in the afternoon.

Big Future Ahead for Williston

MUCH MORE oil and gas is awaiting discovery in the Williston basin. This was the general opinion of more than 600 geologists assembled in Regina, Sask., recently for the second International Williston Basin Symposium.

The overflow crowd of delegates was ample evidence of the reborn interest in the big basin—an interest kindled by a bombardment of new discoveries in 1957 and early 1958. Name badges flashed home towns in Texas, Florida, Pennsylvania, and California, although the meeting was designed principally for Canadians and prairie-state geologists.

Symposium officials had prepared for 350 people, and as one committeeman put it, "650 of these showed up." The 450-seat auditorium of Saskatchewan's new Provincial Museum of Natural History proved to be a standing-room-only proposition.

Dr. T. A. Link, delivering the keynote speech, handed the delegates some blunt advice.

"No new exploration idea," he said, "no matter how outlandish it seems, should be abandoned without fair and unprejudiced consideration."

Link, president of Cree Oil Co. of Canada and former president of the AAPG, warned his geologist audience against "unqualified acceptance of supposedly established or entrenched concepts" and against embracing new and untried theories without serious scrutiny.

Deep drilling urged . . . As for Williston's future, Link declared that a great deal of oil and gas lies yet undiscovered there.

The 134,000-sq. mile basin, stretching over parts of North Dakota, South Dakota, Montana, Saskatchewan, and Manitoba, offers ample room, he said, for many more discoveries to a depth of 15,000 ft. or more. They can be found in a sedimentary section ranging from Cambrian to Tertiary in age.

"And no Williston basin wildcat that stops short of basement rock can be regarded as a fair test of the location," he added.

Today, 94 commercial fields in the basin are producing over 6 million barrels per month. Of this, Saskatchewan is producing about 3 million, Montana 1½ million, North Dakota 1¼ million, and Manitoba a half million.

"Practically all of this production," Link pointed out, "comes from fields discovered since 1950 . . . and they resulted only from intensified wildcatting. The discovery rate is directly related to the intensity and quality of the exploration effort."

Market to grow . . . Prior to Link's keynote address, Resources Minister J. H. Brockelbank told the group that despite the current rough sledding of Canadian producers for a market he expects a steady growth in both production and consumption in the years ahead.

In 1957 alone, he said, Saskatchewan gained over 850 net producing wells. Refining capacity has climbed to 70,000 bbl. per day. The production level in 1958 is expected to reach $100 million.

"And in 1957 for the first time," he added, "the number of producing oil wells in Saskatchewan exceeded the number of grain elevators."

NEW FAULT block discovery in California flows 5,000 bbl. It means . . .

Tejon Strike Is Tops in '58

RICHFIELD OIL CORP.'S closely watched wildcat in the North Tejon area of Kern County was recently completed as probably the state's top discovery of the year thus far. It's a new fault-block find.

It was brought in flowing 1,050 bbl. daily of clean 34°-gravity crude through a 20/64-in. choke from a Vedder sand at 9,165-9,557 ft. The well, 81-24 KCL "I," has since been choked back to 240 bbl. through an 8/64-in. choke.

This wildcat stirred up a flurry of interest several weeks ago when Richfield reportedly tested it for a 5,000-bbl. daily rate on a 1-hour test.

Because Richfield's Vedder zone is some 2,500 ft. higher than Reserve Oil & Gas Co.'s Vedder production in the North Tejon field 1½ miles to the east, Richfield is being credited with a new fault-block find. Conjecture is that it is probably associated with a different anticline than the one in which Reserve found its production some 13 months ago.

Richfield has already spudded in an offset to its discovery two locations to the west. This test, 61-24 KCL "I," was drilling ahead below 4,556 ft.

In Reserve's North Tejon field area, Reserve was drilling below 14,287 ft. on an extension test ½ mile south of its discovery well. This well reportedly tested at a rate of 1,500 to 2,000 bbl. daily in the Vedder at 12,000 ft. before going deeper. This is already the deepest test in the Tejon area.

Present count shows Reserve with three excellent producers in the main area and two drilling. Richfield has its discovery well west of the main area and one drilling.

Both Richfield and Reserve have large holdings in the area and have the most desirable locations pretty well sewed up. Reserve is operator for itself and Standard Oil Co. of California on its holdings in the area.

Dealers Back Bill

for new price-maintenance law on a nation-wide scale.

THE BADLY BATTERED fair-trade issue bounced back into the news last week.

Hearings on a bill to set up a nation-wide price-maintenance law were opened by the House commerce committee.

The bill has the support of gasoline dealers as well as retailers in other lines. It would require every seller to charge prices set by the makers of branded products.

This is the third try at a workable price-maintenance law. The first effort fell because retailers would not sign fair-trade agreements.

The present law makes an agreement effective on all retailers in a state if only one retailer signs it. The highest courts in nearly one-third of the states have held such pacts invalid.

The federal law is a sort of Hot Oil Act for retailers. It merely gives Washington backing for fair-trade laws of the states. At one time 45 or 46 of the states passed such acts.

Price-maintenance laws, most strongly supported by the drug and appliance industries, have been offered as a cure for gasoline price wars but have never been widely tried out in the oil industry.

The House committee may come up with a federal fair-trade bill before the end of the session. But there is little chance of it getting through Congress this year.

Navy to Sell Rigs

and other equipment when Alaska acreage is opened.

OIL OPERATORS securing leases on Alaska's Gubik gas structure when the Interior Department opens the area next month will be given an opportunity to buy drilling rigs and other equipment from the Navy.

The department has notified Interior Sec. Fred A. Seaton that the Navy's inventory of equipment and supplies will be offered for sale as soon as leases are made. The Navy used the equipment in its search for oils in Naval Petroleum Reserve No. 4 in Alaska.

The Navy's material includes 5 rigs of sizes ranging from 1,000 to 20,000-ft. depth, coring and seismic drills, Caterpillar tractors, etc.

Lessees in the area will be invited to look the equipment over, and then make suggestions to the Navy as to

the lots they would like to have put up for sale.

Some equipment suitable for its purpose has been taken by the Air Force for its Dew-line installations. The Navy would like to dispose of the remainder, closing the books on its Arctic search for oil.

OIC Merger Gets Green Light

MERGER of the API's American Petroleum Industries Committee and Oil Information Committee into a more effective public-affairs operation is scheduled for completion by January 1.

Under the new setup, the merged organization will be concerned with both governmental and public relations.

The program was prepared by a nine-man study group headed by Frank Porter, API president, and presented to the board by the API policy, practices, and procedures committee headed by J. Ed Warren, vice president of the First National City Bank of New York.

A new API committee on public affairs will be appointed by September 1 to implement the plan. Instead of being set up on a district basis, as is the OIC, the new organization will operate on a state basis, similar to the APIC.

Salt Dome Pays Off for Texaco

THE TEXAS CO. has hit the jackpot in Freestone County, Texas. It may well have the most important East Texas strike of the past 5 years.

The company's 1 Arthur Rabe, 2 miles northwest of Keechi townsite in the T. J. Teal Survey A-774, has tapped a 249-ft. Woodbine pay section underlying the salt overhang on Oakwood salt dome.

The new discovery had shows of gas and oil throughout a sand section from 5,463 to 5,737 ft. where first signs of water were found. The top 83 ft. indicated commercial gas content, and about 166 ft. of lower sand contained oil.

Texaco cored the section, recovering 48 ft. of gas sand between 5,501 and 5,549 ft., 50 ft. of oil sand at 5,549-99 ft., and 116 ft. of oil sand was picked up between 5,599 and 5,737 ft. Woodbine top was recorded at 5,463 ft.

After reaching total depth of 5,863 ft., electric log was run and an additional 35 ft. of gas sand in top of the Woodbine was revealed between 5,463 and 5,501 ft.

Two drill-stem tests were run. The first, at 5,500-49 ft., flowed an unestimated amount of gas. The second, at 5,549-99 ft., with tool open only 10 minutes, flowed and unloaded oil with top pressure of 650 psi.

Recovery was about 3,000 ft. of 40°-gravity oil. Production pipe was run to bottom, perforations were made in a 10-ft. section at 5,660-70 ft., and the well is awaiting potential gage.

4,000 ft. of salt . . . The importance of this strike lies not only in the unusually thick section of lush Woodbine pay, but in the nature of the exploration itself.

Texaco drilled through more than 4,000 ft. of the salt-dome overhang to reach the reservoir. Top of the salt was about 1,200 ft. and the bit didn't come out until 5,285 ft.

Even more important, the discovery gives the East Texas embayment its fourth productive salt dome structure.

There are 18 known domes in the area, and they have defied the best efforts of East Texas operators for decades. Four had previously yielded some production—Boggy Creek, Concord, Bethel, and Hainesville. Concord dome has long been abandoned.

The new Oakwood success is the first, however, to indicate really major-field possibilities and undoubtedly will lead to a complete reexamination of the 18 structures.

INDUSTRY BRIEFS . . .

Seaboard Oil Co.'s directors last week approved a merger with Texaco Seaboard, Inc., a new firm wholly owned by The Texas Co. The merger plan will be put to a vote of Seaboard stockholders May 23 in Dallas.

It calls for Seaboard to transfer all of its properties and assets to Texaco Seaboard in exchange for shares of The Texas Co. stock and assumption by Texaco Seaboard of all Seaboard's liabilities. Shares would be traded on a one-for-one basis.

American Maracaibo Co. plans to change the name of the company to Felmont Petroleum Corp., an adaptation of the name of its North American subsidiary, Felmont Oil Corp. American Maracaibo has no operations in the Maracaibo basin. Its principal holdings are in the Eastern Venezuela basin.

Tidewater Oil Co. announced last week that David T. Staples, president, has been elected chairman of the board of directors, and George F. Getty II has been elected president to succeed Staples.

Getty, son of J. Paul Getty, president of Getty Oil Co., has been vice president and general manager of Tidewater's eastern division for the past 2 years.

Announcement of the change was made at the annual shareholders meeting in Delaware. The younger Getty first entered the oil business in 1947 as an independent operator and in 1949 joined the Pacific Western Oil Corp., now Getty Oil Co.

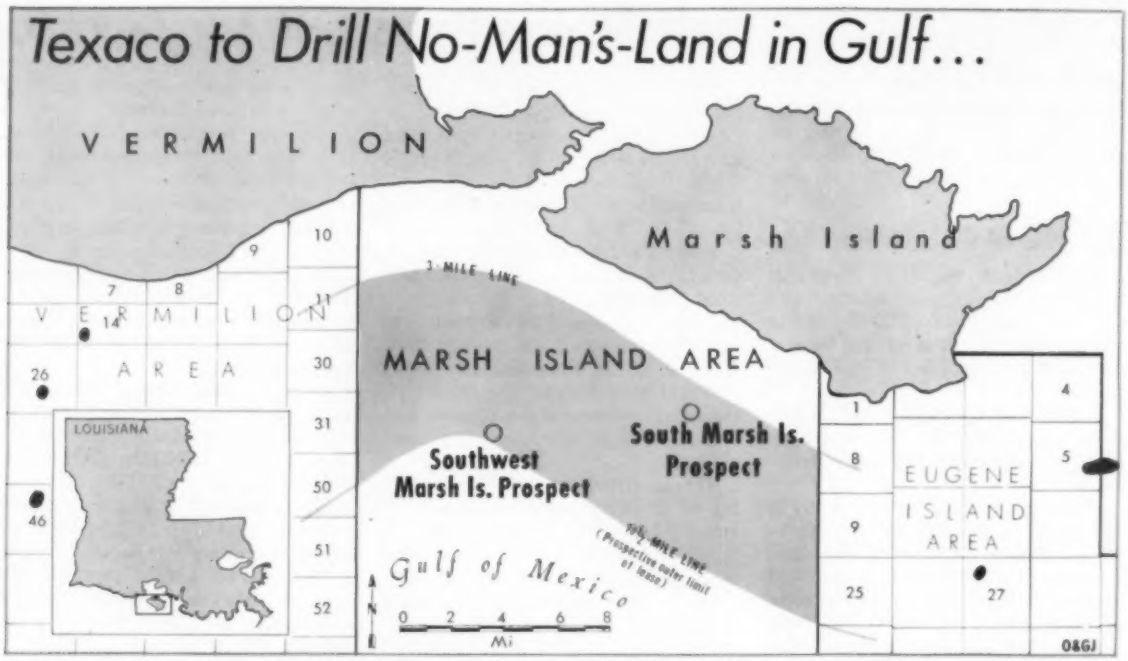
Louisiana's oil-production allowable for May has been reduced to its lowest level since September 1956. State Conservation Commissioner John B. Hussey set the May month's allowable at 744,576 bbl. daily, a reduction of about 25,000 bbl. below the April figure.

The Oklahoma Corporation Commission has held Oklahoma's production allowable at virtually the same level for May as it was for April. The May output should hit about 515,000 bbl. per day. April runs averaged around 525,000 bbl., some 10,000 bbl. above the original estimate because of a carry-over allowed on certain wells from March.

Esso Shipping Co., which operates 54 ocean tankers, will become the marine department of Esso Standard Oil Co. July 1. Millard G. Gamble, president, will become a consultant to the parent company, Standard Oil Co. (N. J.). John D. Rogers, executive vice president, will become manager of the new department.

Sinclair Crude Oil Co. has put most of its high-gravity crudes and condensates on a 2-cent per degree downward escalation. The adjustment applies to crudes above 44.9° gravity.

Sinclair also reduced the price on Texas Coastal Grade B type crude 5 cents to $3.25 a barrel and adjusted flat prices for condensate in Chapel Hill (Texas) and Big Sand Draw field (Wyoming) downward by 25 cents to $3 a barrel.



Disputed Louisiana Lease Looks Hot

• State and federal agencies finally have agreed to allow drilling in South Marsh Island waters after years of legal wrangling, going back to Huey Long. Successes in nearby offshore blocks mean the area should be a producer.

THE TEXAS CO. is preparing to drill the first offshore wells on a large block in the Gulf of Mexico which it has held under a disputed lease for two decades.

The locations are in the great unchartered waters off the coast of Louisiana on what is probably the largest and most controversial lease ever issued by the state. The wells will be drilled in the disputed area where both the federal and state governments claim jurisdiction.

Two of the three well sites are near Marsh Island in a vast no-man's land which shows up as a big blank spot on offshore maps (see above). The area, roughly 18 miles wide, is between the Vermilion and Eugene Island blocks. For 22 years map makers have carefully avoided the area, pretending it didn't exist.

Cartographers had reason for their aloofness. The Marsh Island area is coextensive on the east and west with State Lease 340. The lease also covers some inland waters north of Marsh Island, but for years nobody seemed to know how far it extended to the south.

The third Texaco location is farther east, in the Rabbit Island area off St. Mary Parish. Although nearly 30 miles from the nearest Marsh Island location, it also is in the sprawling acreage covered by State Lease 340.

Hot issue . . . Mere mention of fabulous State Lease 340 is enough to start a heated argument in Louisiana political circles. Lawyers have debated it for years, both in and out of court. Until recently its seaward boundary had never been determined.

Even Texaco has practically ignored the lease in recent years except to arm its attorneys with voluminous documents intended to defend the company's rights to the area.

The original Texaco lease embraced an inland area much larger than that claimed now. In addition to the offshore acreage of undetermined size, the disputed lease covered most of the bottoms of coastal waters extending from Pointe au Fer, on the tip of Terrebonne Parish, west and north to the boundary between Cameron and Vermilion parishes, a distance of more than 80 miles.

Some of the coastal portions of the lease have been intensively and profitably developed by The Texas Co. Half a dozen fields have been discovered in the coastal areas. These include such fields as Cote Blanche Island, West Cote Blanche Bay, Rabbit Island, Vermilion Bay, and Lake Sand. Their cumulative production totals more than 30,000,000 bbl. of crude oil plus large volumes of natural gas.

Texaco's proposed wells, however, would be the first ever drilled in the offshore waters of the Marsh Island area. The company has drilled a number of wells north of the island in the inland waters and has had one dry hole on the partially submerged island itself.

The company's new plans were disclosed in routine applications for drilling permits. The State Department of Conservation granted the permits after ratification of the lease by federal authorities.

The two Marsh Island wildcats are projected to 13,000 ft. The other well is expected to test sands from about 8,000 to 10,500 ft. which produce in nearby Rabbit Island field.

Contractor for the jobs had not been named last week, but a Texaco spokesman indicated drilling is expected to begin in the near future.

Why the action . . . One reason for

Texaco's sudden move to open waters may be the implied threat of the State Mineral Board to cancel state leases which have not been reasonably developed. The board for several months has been making a survey to determine which operators have been lax in developing their leases from the state.

A more immediate reason for Texaco's decision may be found in a recent favorable ruling by Elmer F. Bennett, a U. S. Department of Interior solicitor. Last February Bennett issued an opinion setting the seaward limit of Lease 340 at 3 leagues, or about 10½ miles, from the coastline.

Although Texaco had claimed a boundary 27 miles out in the Gulf of Mexico, Bennett's ruling is a major victory for the company in the long stalemate which has prevented exploration and development of the lease. An official of the U. S. Bureau of Land Management said last week the lease has been validated to the 3-league line "by Washington."

With the 3-league boundary apparently established, the lease covers approximately 120,000 acres underlying open waters of the Gulf of Mexico. Setting the boundary at 3 miles from shore would have limited the portion in the gulf to about 40,000 acres.

The history . . . As originally drawn 22 years ago, the lease would have included approximately 250,000 acres along the coasts of Vermilion, Iberia, St. Mary, and Terrebonne parishes in addition to the part underlying the Gulf of Mexico. Part of the acreage under inland waters and later released by the company, however, and the exact acreage still held there is a matter of conjecture.

State Lease 340 was issued February 7, 1936, to William T. Burton. He was an agent of a small company in which former Gov. Huey P. Long, self-styled Kingfish of Louisiana politics, is said to have been a "silent" partner. Long, who went from the governor's mansion to the U. S. Senate, was assassinated a few months before the extensive lease was granted.

Burton reportedly paid a $75,000 bonus for the lease. A week later he assigned it to The Texas Co.

During the post-Long era the lease became the center of a lingering dispute involving charges of "favoritism" toward friends of the late senator.

In 1943 the Mineral Board negotiated an agreement whereby Texaco relinquished its claim to large portions of the acreage originally involved. The retained portions covered 12 areas, including the Marsh Island acreage which was to extend into the Gulf of Mexico "to the extreme limit or boundary of the domain, territory, and sovereignty of the State of Louisiana . . ."

That's where the federal Government entered the case. Under the Interior Department's interpretation of the Submerged Lands Act of 1953, Louisiana's boundary is only 3 miles from the coastline. Louisiana claims the line should be 3 leagues. The boundary question is now before the U. S. Supreme Court.

In addition to the Supreme Court case, the District Court of Iberia Parish has before it a suit in which Superior Oil Co. has challenged Texaco's claim to acreage beyond the 3-mile line. This suit has been in court for years.

About a decade ago Superior obtained a court order barring Texaco from drilling beyond the 3-mile line. This order apparently has not been rescinded, but Superior has indicated it will not seek to have the ancient ruling enforced at this time.

Top potential . . . Aside from the legal ramifications, Texaco's proposed wildcats have attracted enormous interest from a geological point of view. The big unexplored area extends offshore from some of the greatest fields in Louisiana. Important production also has been established in the offshore areas to the east and west of the locations.

Texaco's competitors, who have had geophysical crews at work in the Gulf of Mexico for years, have yielded to curiosity in trying to appraise the potential of the neighboring property. From subsurface information, they have been able to piece together an enticing picture of geological formations beneath the unexplored waters.

As one of Texaco's competitors puts it, there are some "hellacious" structures awaiting the drill bit. Proposed drill sites are naturally over some of the most favorable prospects.

Permit problem . . . Since the locations are in the disputed zone between the 3-mile and 3-league lines, both federal and state officials had to give their approval before drilling permits were issued.

A routine notice from the Corps of Engineers has invited protests "from the standpoint of navigation," but this is the usual procedure before permits are granted for erection of drilling barges or platforms in the open waters of the gulf.

The Texas Co. was turned down three times on applications to the Bureau of Land Management for certification of the state lease insofar as it pertained to areas where the federal Government claimed jurisdiction.

In effect, the recent ruling by Solicitor Bennett reversed the decisions of the director and acting director of the Bureau of Land Management on this point. Bennett recognized the 3-league line as the southern boundary of the lease and returned the case to the Bureau of Land Management for compliance.

The Bureau of Land Management is an agency of the Interior Department, which insists that Louisiana's seaward boundary does not extend more than 3 miles from shore. Despite the apparent contradiction, federal officials contend the reversal does not weaken their case before the Supreme Court.

Indiana Leases Toll Sites

STANDARD OIL CO. (Ind.) will build six combination service stations and restaurants along the Northern Indiana Toll Road.

The company will spend $2,080,000 for new buildings, which will be completed early next year. The property will revert to the Indiana Toll Road Commission when the 25-year leases expire.

Standard has agreed to pay rentals based on percentage of sales. This will include a graduated scale beginning at 5 cents per gallon on gasoline sales, and ranging up to 7 cents depending on yearly volume; 14.2 cents per gallon on motor oil sales; and 10.7% on other sales and services.

The company estimates its average annual gasoline sales over the 25-year period will be 10,163,000 gal. There are 10 other service areas along the highway, with five other major brands represented.

Big Looping Project Planned

EL PASO Natural Gas Co. plans to loop its main line from Plains, in the Texas Panhandle, to the California border by 1960.

The extensive construction will be necessary to deliver an additional 200,000 M.c.f. daily to Pacific Gas & Electric Co., which has agreed to purchase this volume. Increased deliveries will start next year with the full volume to be reached in 1960.

El Paso plans to supply PG&E's growing requirements from sources in the Permian basin of West Texas and southeastern New Mexico.

El Paso plans to spend $160 million this year to increase system capacity by 285,000 M.c.f. daily through construction of some 1,000 miles of trunk and gathering lines and 68,000 hp. in compression.

Tough Import Plan Fading in Congress

• Carson announces new rules on voluntary program and sets hearing on new quotas for West Coast. Policy clarified on denying government contracts for firms not complying. Carson and Weeks battle mandatory bill.

ADMINISTRATION officials are confident that Congress will not write mandatory oil import controls into the Reciprocal Trade Act.

Two developments last week increased their optimism:

... Interior Sec. Fred A. Seaton proposed subsidies for domestic metals whose producers also have been pressing for quotas.

... The House ways and means committee called for further information on the working of the voluntary crude program before deciding whether to amend the national security clause (Sec. 7) of the trade act.

Commerce Sec. Sinclair Weeks, chairman of the cabinet fuels committee, and Capt. M. V. Carson Jr., program administrator, talked with the committee behind closed doors and made a strong argument for the present plan.

Weeks and Carson said that the effort to limit crude imports by cooperation has been highly successful. Carson added that imports into Districts 1-4 have been cut in the last 9 months from 16% to 13% of domestic production (see next page).

But if the program in the future shows signs of breaking down, the two officials pointed out, the President can quickly make it mandatory. It then would have all the force and effect of specific controls written into law.

Seaton's subsidy offer and the Weeks-Carson talk with the committee are seen in some Washington quarters as taking much of the heat out of the drive for the Ikard bill. But other sources said these developments will not stem the demand for formal quotas.

New quota hearings ... The week also was marked by announcement of Carson's plan to hear requests for new and additional quotas for crude imports into District 5 and the issuance by Carson, the Defense Department, and the General Services Administration of rules to make effective the President's revision of the Buy American Act.

Carson next week will hold a series of hearings on the requests of eight companies for quotas under the District 5 (West Coast) program and four others seeking increases in their allocations.

Initial quotas have been asked by the Bankline Oil Co., Rothschild Oil Co., Golden Eagle Refining Co. (formerly Sunset), Manespo Refining Co., Envoy Petroleum Co., Century Oil Co., Socal Oil & Refining Co., and Palomar Oil & Refining Corp.

Increased allocations are sought by Macmillan Petroleum Corp., Caminol Co., Douglas Oil Co., and Hancock Oil Co.

Import rules ... The new regulations of the Defense Department and the GSA spell out the conditions under which Government oil contracts will be awarded to both importers and foreign refiners. Carson laid down the rules under which certificates of compliance will be issued.

The new Defense Department ruling covers products containing any foreign crude, no matter how little. The former practice was to consider as foreign-derived only those products with a "substantial" amount of foreign crude.

Domestic refiners are advised that bids will not be accepted for products from foreign oil not imported in compliance with the voluntary program.

Offers of foreign refiners will be accepted only (1) if no bids are received for products from domestic or legally imported crude or (2) if bids are made but are 6% or more in excess of the foreign offer plus transportation cost to point of delivery and the import tax, even though the tax is not imposed.

The requirements of the order may be waived under four conditions:

... When products are for use outside the continental U. S.

... When the government determines that neither domestic nor complying products are produced or refined in the U. S. in sufficient and reasonably available quantities and of a satisfactory quality.

... When the Secretary of Defense decides it would be "inconsistent with the public interest" to apply the preference to domestic or complying product.

... When the secretary determines the cost of domestic or complying product to be unreasonable.

The new ruling will affect more than $250 million in offshore oil buying by the Military Petroleum Supply Agency.

The policy ... The GSA ruling holds it "to be inconsistent with the public interest for any purchase to be made by the General Services Administration of a nondomestic petroleum product which is not a complying petroleum product, unless a domestic product is unavailable or its cost is determined by GSA to be unreasonable."

Cost is considered "unreasonable" when it exceeds the cost of a noncomplying imported product by more than 25% at the point of delivery, or exceeds the cost of a foreign refined product, plus transportation and import tax, by more than 6%.

Carson's regulations set up standards for judging whether importers seeking government contracts have complied with the voluntary program during the 3 months prior to the submission of bids.

Technicalities ... The rules provide that importers with allocations under both the East Coast and West Coast programs must be in compliance in both areas to be eligible for compliance certificates.

A parent company and its wholly owned or majority-controlled subsidiaries will be regarded as a single organization.

A refinery which itself is in compliance with the program may lose its right to a certificate if any noncomplying foreign trade taken under a processing agreement is commingled with its own supply.

Importers who cannot comply with the program because of the difficulty of scheduling tanker shipments are given the right to store foreign crude in bond and charge the crude against their allocations for the month in which it is withdrawn.

For importers in District 1-4 separate provision is made for determinations of compliance prior to July 1, 1958, and subsequent to that date. The rules recognize that the original program was to run to June 30, while the current program runs to September 1.

Voluntary Import Plan 97% Effective

THE RESULTS of 9 months of voluntary crude import control were totaled up last week by Capt. M. V. Carson, Jr., administrator, and found to be good.

The program "has been over 97% effective, despite the noncompliance of a handful of companies," Carson reported.

The administrator gave full credit for this result to "the importing oil companies which have displayed a marked degree of business statesmanship in cooperating with the Government on an individual, voluntary basis."

Compliance figures . . . Crude imports into District 1-4 averaged 801,100 bbl. daily for the 9-month period, from July through March. This was only 2.3% above the finally revised recommended level of 782,900 bbl. per day.

Carson pointed out that the program did not become fully effective until last September. From that month through March, he said, imports averaged only 765,600 bbl. daily, almost 2% under the recommended level. That was a ratio of 12.5% of domestic crude production, he pointed out.

For the 9 months as a whole, however, imports were reduced 168,900 bbl. daily, or 17.4% under schedules for the last half of 1957 made up by importers before the program was adopted.

"Crude-oil imports, as scheduled at that time, represented 16% of domestic crude-oil production in District 1 through 4," Carson said. "Today, that ratio stands at 13%, and we are well ahead of schedule in reaching the ratio of 12% recommended by the President's special committee."

Big March increase . . . The final report on the original program showed that imports in March jumped to 844,200 bbl. daily from 670,000 bbl. daily in February. Only one established importer and nine new importers were at or below quota level for the month.

Two of the three leading companies failing to comply with the program in the past appear ready to stay within quotas. Tidewater Oil Co. announced its February-April imports will be within the quota and will remain there in the future. Sun Oil Co., in March had 41,800 bbl. daily against an allocation of 50,400. Eastern States Petroleum Co. was still 10,000 bbl. above quota in March.

For the 9 months as a whole, the seven established importers wound up with average receipts of 492,200 bbl. daily or 900 bbl. below the group quota of 493,100 bbl.

The 20 new importers, however, had an average of 308,900 bbl. daily, or 19,100 bbl. above their allocation of 289,800 bbl.

District 5 . . . A separate report on the District 5 program showed that March imports into the West Coast area were 151,600 bbl. daily against an allocation of 220,100 bbl.

Only three importers failed to meet their quotas in March. No imports at all were reported by the six new importers, or by three of the four small importers, or by one (Richfield) of the eight majors.

Imports Stayed Within Quotas—Almost

DISTRICTS I-IV

(Thousands of barrels daily)

Established importers:	Allocation March 31, '58	Actual March '58	9-mo. average
Atlantic	58.9	62.9	60.1
Gulf	111.6	109.1	111.5
Sinclair	62.2	68.2	63.3
Socony-Mobil	67.1	69.4	70.4
California Standard	66.8	66.9	65.2
Jersey Standard	72.0	85.0	65.9
Texas	54.5	61.7	55.8
Subtotal	**493.1**	**523.2**	**492.2**
New importers:			
Cities Service	32.6	14.0	27.8
Crown Central	5.0	4.1	2.2
Eastern States	18.3	28.7	24.7
Gabriel	7.5	19.5	7.9
Great Northern	33.0	34.2	30.7
International	12.3	6.5	9.2
Lakehead Pipeline	0.3	0.3	0.3
Lake Superior	5.0	6.9	4.3
Northwestern*	13.5	18.0	11.3
Phillips	12.0	26.4	11.8
Shell	7.5	17.9	3.6
Indiana Standard	29.8	21.4	30.0
Standard of Ohio	8.2	20.1	8.8
Sun	50.4	41.8	56.2
Tidewater	34.2	40.1	62.6
Southwestern Oil & Refining	2.9	3.7	2.4
Bay Refining	3.2	2.6	3.0
Dow Chemical	0.3	0.3	0.3
Texas Asphalt	2.3	3.5	0.4
Hess, Inc.	11.5	11.0	11.4
Subtotal	**289.8**	**321.0**	**308.9**
GRAND TOTAL	**782.9**	**844.2**	**801.1**

*Estimate from February report.

IPAA Supports Ikard

. . . in principle, but it declines blanket endorsement. Chief hope: Bill making '54 imports ratio mandatory.

THE INDEPENDENT Petroleum Association of America, at its midyear meeting in Chicago, voted to "enthusiastically endorse and support the principle of the Ikard bill (H.R.1178)."

The association beat down attempts, made chiefly by Texas independents, to endorse the Ikard bill specifically instead of "in principle." Also lost were various suggestions that the Ikard bill be endorsed with perfecting amendments of various kinds.

Discussion of the resolution, both in and out of the formal session, made it clear that the IPAA's chief interest in the Ikard bill is the principle that

Congress write into law that imports of crude oil and refined products shall not exceed the 1954 ratio (16.6%) to domestic crude production.

Operating mechanics of the Ikard plan received little discussion. The bill provides for import licenses to be sold to the highest bidder. Those who inquired how this might work out under specific circumstances were advised that Congress could take care of such problems by rephrasing the bill or that the President would have power to deal with them by administrative rulings.

The bill's author, Rep. Frank Ikard of Texas, told the meeting that legislative action must be taken during this session to spell out a workable plan for the control of both crude and product imports. He described the present voluntary program as uncertain as to effectiveness and duration.

But Ikard said he is not wedded to this particular proposal in every detail.

Government's position . . . The association listened politely to a defense of the present program by Frederick H. Mueller, Assistant Secretary of Commerce.

Mueller said the voluntary program has been 98.4% successful in holding crude imports to the level set by the Office of Defense Mobilization as safe for national security and that enforcement steps are now being taken to penalize those not in compliance.

"Those in Washington charged with the responsibility for making sure that imports do not threaten our security posture and our economy believe that the voluntary acceptance of importers of levels considered safe is preferable to mandatory restrictions," Mueller said.

"Notice has already been served on the petroleum industry that if the time ever comes when it is necessary to clamp on mandatory controls the Eisenhower administration will take immediate and unequivocal action.

"On this basis, I see no reason for the domestic oil industry to be unduly alarmed or fearful.

"I think it might be well to put in a word about those few who didn't cooperate. The best information shows that they are bending every effort to conform and get under the President's latest suggested import quotas.

"A question that comes up repeatedly is whether the Buy American Act actually will work in the petroleum situation. My answer is that any effort by those few importing firms who refused to go along with the initial program to get under the wire of a reduced quota is answer enough."

Opposing view . . . Some members immediately challenged Mueller's claim of effectiveness.

They conceded that the voluntary program has kept the number of barrels of foreign crude close to the volume requested by the administration last July. But because domestic production has declined, the ratio of imports to production has gone up.

Also they complained that the administration started with the 1955-56 ratio instead of the lower 1954 ratio. And they said the failure to limit products opens a loophole that may endanger the whole import control program.

After some argument, the imports policy committee agreed to admit that the voluntary program has accomplished substantially what it set out to do, but that IPAA wants the crude level lower and wants products restricted.

Mueller replied that the crude imports level was set by ODM certification as to imports that would not endanger national security and that ODM had declined to certify that product imports poses a threat at this time.

The figures . . . A statistical study made for the imports policy committee showed that in July, 1957, importers had scheduled crude imports averaging 1,267,000 bbl. per day for the last half of the year. The government program, announced in July, reduced this to a level of 1,031,000 bbl. per day.

The goal was lowered to 990,000 bbl. per day in January and to 933,000 in April. Had the 1954 ratio to domestic production been followed, the permissible level of crude imports currently would be 670,000 bbl. per day.

Attainment of this 1954 ratio appeared to be an accepted fetish with IPAA. There was no discussion of it beyond statements to the effect that it is generally accepted domestic producers would not be harmed by such a level of imports provided the program is applied to products as well as crude.

Much doubt was expressed that the voluntary program could be enforced. It was repeatedly stressed that the level and the enforcement should be established by Congress rather than by the President.

A few participants in the discussion raised fears of federal regulation of the oil industry growing out of import controls. This was quieted by one member with the remark that "I would rather be regulated by my Government than by my competitors."

Independents Hit Merger Bill

INDEPENDENT producers are highly fearful of the effects of a law to require advance notice to the Government of proposed mergers.

The bill is urged by the Justice Department and Federal Trade Commission as a means of preventing monopolistic mergers.

But its effect "might very well be to force a concentration within the large companies, rather than, as is its purpose, to prevent such concentration," H. M. McClure, Jr., president of the McClure Oil Co., told the Senate antitrust subcommittee.

McClure, president of the National Stripper Well Association and a member of the executive committee of the Independent Petroleum Association of America, appeared before the subcommittee as spokesman for both organizations.

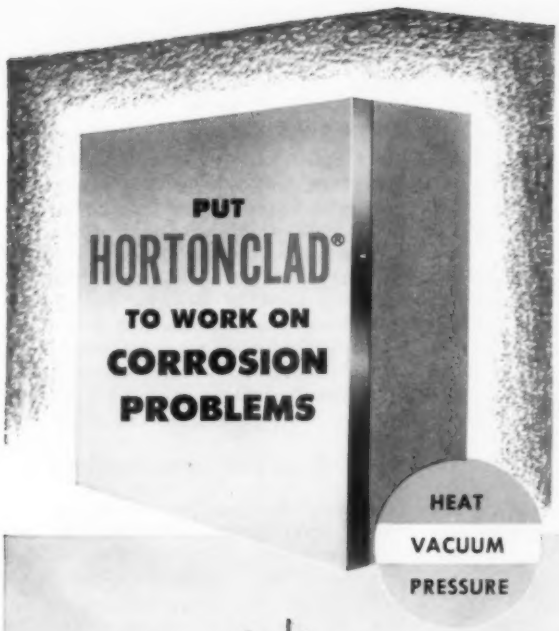
The independent producer normally meets his needs for heavy capital to develop a find by selling part of his interest, McClure explained. He may raise money to go into a new good prospect by selling off other properties. In the same way he may get money to start drilling to prevent the loss of a lease.

Time is vital . . . The time element is important in many of these cases, McClure said. The need to give the Government 60 days advance notice could be disastrous.

"The freedom to trade properties is particularly vital to the independent oil producer," he said. "He must have unrestricted opportunity to buy and sell assets and do it quickly.

"He must have this freedom if he is to be able to raise the funds with which to stay in business. This problem is not so crucial with the larger companies. They have other means of obtaining their financial needs and could probably adjust to the situation without trading or buying and selling assets as is done today.

"If the independent is restricted in this manner, the future growth and development of the domestic oil industry would be further seriously injured in addition to the many existing adverse factors which are now threatening its very existence," he warned.



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- CLEAN, CONTAMINANT-FREE SURFACE
- ADAPTABILITY TO ANY SIZE OR SHAPE

Two crude columns (left) and vacuum column (right) were partially clad using Monel Hortonclad and stainless steel. Crude columns are 174-ft. high. Vacuum column is 28-ft. in dia. at widest point and 125-ft. high.

P71-C

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THE TOWER being built as part of California's first permanent offshore . . .

Platform Nearing Completion

ONE OF THE most complex marine engineering jobs ever attempted on the Pacific Coast will be performed early next month.

The project involves towing a $2.3-million drilling platform from San Diego and landing it at Summerland off Santa Barbara County.

The platform, being built for Standard Oil Co. of California, Western Operations, Inc., will be used to develop the 5,500-acre offshore parcel awarded Standard of California and Humble Oil & Refining Co. for a $7,250,000 - bonus bid in January 1957. Standard of California will be operator.

The platform will be novel for California for two reasons:

. . . It will be the first permanent offshore drilling platform off the West Coast.

. . . It will be the first two-well derrick for simultaneous drilling of two holes to operate in that part of the country.

Complex moving problem . . . The 1,000-ton tower (see photo), under construction at National Steel & Shipbuilding Co. of San Diego, will be towed the 200 miles from San Diego to Summerland by two tugs.

The trip is expected to take 3 days at a speed of 3 knots per hour.

The tower will be floated on four caissons, each about 27 ft. in diameter and 40 ft. high. These caissons will serve as permanent foundations for the four platform legs.

During the tow, the caissons will be pressurized to 10 psi. to prevent leakage, and each will be ballasted with 90 tons of sand for stability. They will draw about 20 ft. of water.

Placing the tower . . . To position the tower at its site in 100 ft. of water, J. Ray McDermott & Co. is towing a New Orleans-built derrick barge to Summerland.

The 90 by 100-ft. barge mounts a 220-ft. boom with a 250-ton capacity.

At the site about 2 miles from shore, lines from the crane boom will be hooked to the top of the tower. Buoyancy of the caissons will be reduced by adding water until the tower begins to sink to the ocean floor. The rate of descent will be controlled by the derrick crane boom.

The caissons will be jetted into place in the ocean floor by high-pressure water and air. They will be anchored by being filled with 6,000 tons of sand and concrete. The jetting in will take about 6 days, and the anchoring another week.

When this phase of the work is finished, the three-tier, 110-ft. square deck, also built by National Steel & Shipbuilding, will be mounted on the tower. The bottom of the drilling deck will be 50 ft. above the water.

The outstanding feature of this platform will be the 140-ft. derrick capable of drilling two wells simultaneously. The derrick and the substructure were fabricated by Lee C. Moore in Tulsa. They are being assembled at Long Beach.

The derrick is designed with two crown blocks and two separate hoists. It will have a 30-ft. crow's nest and a 45-ft. square derrick floor. As many as 25 wells can be drilled on 6-ft. centers.

Under California law, offshore structures must be designed to accommodate a minimum of 24 wells.

Standard of California expects to start drilling from the new platform some time in July.

Aneth Pool Linked to McElmo

SUPERIOR OIL Co. has apparently connected huge Aneth field with McElmo Creek field southeast of Aneth in Utah's Paradox basin.

The 11-31 Navajo-C, a long northwest extension to McElmo Creek, flowed 124 bbl. of oil in 3 hours from Paradox perforations at 5,646-57 ft. and 5,665-5,723 ft.

Superior calls the well an extension to McElmo Creek, but actually it is closer to Aneth's southeast limits. The new producer is apparently a link between Aneth and Superior's 1957 tight-hole discovery 1 mile to the southeast.

PIPELINE

Trans-Canada Pipe Lines, Ltd., will spend $165 million to complete its Alberta-Montreal gas line this year. C. S. Coates, Trans-Canada president, told stockholders that 3,000 men would be working in the field laying the final 853-mile, 30-in. link between Port Arthur and Toronto, Ont.

The Alberta - Port Arthur and Toronto-Montreal sections were completed last year and are now operating. The eastern section is being supplied by Ontario gas borrowed from Union Gas Co. of Canada, Ltd., to aid market development pending arrival of Alberta gas this fall.

Humble Pipe Line Co. completed pipe laying last week on a 90-mile, 16-in. crude line between Hawley and Comyn on its Panhandle - Gulf Coast system. O. R. Burden Construction Corp, Tulsa, the contractor, will require about 10 days more for cleanup. The new line will have capacity of 99,000 bbl. per day.

Act Oils, Ltd., organized by Canada Southern Petroleums, Ltd., and

Three Gas Companies Indicted

. . . by federal grand jury. Justice Department alleges conspiracy to monopolize gas sales in upper Midwest.

A FEDERAL grand jury in Milwaukee last week indicted three companies and their top officials on charges of conspiring to monopolize sale of natural gas in the upper Midwest.

Indicted were Peoples Gas Light & Coke Co., Chicago, and its former chairman, James F. Oates, Jr.; American Natural Gas Co., Detroit, and Ralph T. McElvenny, president; and Northern Natural Gas Co., Omaha, and John F. Merriam, president.

They were accused of conspiring since 1954 to prevent Midwestern Gas Transmission Co., subsidiary of Tennessee Gas Transmission Co., from importing natural gas from Canada into their marketing territories.

The indictment, announced by Atty. Gen. William P. Rogers in Washington, alleged the companies coordinated their activities to prevent interstate transportation and sale of natural gas in Wisconsin, Minnesota, Michigan, and Illinois by any new competitor.

The Justice Department charged that the companies' action kept consumers in parts of these states from obtaining natural gas.

Frank M. McMahon, president of Westcoast Transmission Co., Ltd., Calgary, and Russell E. Ritchie, vice president of Stone & Webster Corp., were named as co-conspirators but not as defendants.

The grand jury was called at the behest of Governor Thompson of Wisconsin who said the companies had failed to meet rising demand in their market areas.

Charges denied . . . The companies denied the charges, which carry penalties on conviction of up to $50,000 fine for corporations and $50,000 fine or 1 year in prison, or both, for individuals.

McElvenny said American Natural's opposition to Midwestern was based upon the knowledge that the Midwestern pipeline was not economically feasible and would be detrimental to the consumer.

He said that position had since been supported by the staff of the Federal Power Commission, which recently rejected all competitive proposals in the Midwestern case (OGJ, Apr. 7, p. 118). Midwestern's plan, although disapproved by the staff, was called "very clearly the best in concept."

Merriam said that Northern was the first company to file an application to serve northern Minnesota communities. ". . . It is annoying to us," he said, "that we should be accused of conspiring to block service to those communities."

Peoples recently agreed to purchase gas from Midwestern if Midwestern could construct its system and start service next winter.

Northern, American, and Peoples last year were ordered by the Justice Department to cease talks designed to give them equal partnership in Midwestern with Tennessee, which refused to relinquish control of the company.

Conoco Buys Buffalo

CONTINENTAL Oil Co. will acquire the producing properties and nonproducing acreage of Buffalo Oil Co., Tulsa. The transaction was announced last week by L. F. McCollum, Conoco president, and H. P. Taubman, Buffalo chairman.

Most of Buffalo's properties are in Oklahoma, Texas, New Mexico, and Louisiana.

Details of the agreement were not disclosed, but it reportedly will involve both cash and oil payments. Buffalo's current crude-oil production is estimated at about 7,000 bbl. per day.

BRIEFS . . .

Canso Oil Producers, Ltd., believes crude-oil reserves in northeastern British Columbia will justify a large-diameter line to the coast by 1963. The company proposes to build a line from Fort St. John to Kitimat, which is located north of Bella Coola, the terminal announced originally.

In hearings before the Borden Commission, the company estimated a 30-in. line on this 450-mile route would cost $130 million. It would have capacity of 100,000 bbl. per day with one pump station and 200,000 bbl. daily with three stations. Tariff would be 25 to 30 cents.

Consumers Power Co. and the affiliated Michigan Gas Storage Co. have awarded contracts to Midwestern Constructors, Inc., to build 85 miles of 24 and 26-in. gas line.

Consumers will build 45 miles of 24-in. from Overisel gas field to Woodbury station in Michigan. Michigan Gas will lay 40 miles of 26-in. loop from Ithaca to Stevenson Lake junction along its main line from storage fields.

Sadler Brothers Pipeline Construction Co., Oklahoma City, has been organized by Vernon L. Sadler, Drumright, Okla., and Roy E. Cook and Leo F. Sadler, both of Oklahoma City.

Vernon Sadler has been welding superintendent for R. B. Potashnick, Cape Girardeau, Mo., the past 7 years. Roy E. Cook has been assistant vice president of Schafer Drilling Co. the past 3 years. Bill Sadler has been with Vaughn-Taylor Construction Co., O. C. Whitaker, Anderson Brothers, R. B. Potashnick, and H. C. Price Co. The company's first project is a 21-mile gathering system near Moore, Okla., for Sunray Mid-Continent Oil Co.

Gulf Interstate Gas Co. has awarded contract to H. C. Price Co. for 132 miles of 30-in. loop in Kentucky and Tennessee. The four sections are a part of a 352-mile loop planned along the company's main line. Houston Contracting Co. will lay the other six sections in Louisiana, Mississippi, and Tennessee (OGJ, Apr. 28, p. 60). Construction is scheduled to start soon after June 1, with completion by November 1.

Also for Pipeliners . . .

IN THE NEWS: Three midwestern gas-pipeline companies have been indicted by Milwaukee federal grand jury (p. 79) . . . It appears now that only a miracle can revive the Harris-O'Hara gas bill (p. 82) . . . Aminoil plans to expand its pipeline and terminal in Kuwait as part of stepped-up program in Neutral Zone (p. 89) . . . French still face dilemma of growing production in the Sahara, but inadequate pipeline facilities (p. 89).

PLUS THESE TECHNICAL REPORTS: Four Corners pipeline (p. 113) . . . Constructing meter provers (p. 133).

How East and West Compared in 1957 Seismic Work

(Crew-Months of Geophysical Exploration)

	Western Hemisphere			Eastern Hemisphere			World		
	1956	1957	% Change	1956	1957	% Change	1956	1957	% Change
Seismic	9,062	8,556	−5.6	1,983	2,506	+26.4	11,045	11,062	+ 0.15
Gravity	1,369	1,266	−7.5	855	688	−19.5	2,224	1,954	−12.1
Magnetic	127	136	+7.1	166	264	+59.0	293	400	+36.5
Other	18	.....	.....	48	51	+ 6.3	66	51	−22.7
TOTAL	10,576	9,958	−5.8	3,052	3,509	+15.0	13,628	13,467	− 1.2

Geophysical Oil-Hunt Picks Up Abroad

• Exploration is down slightly world-wide because of drop in U. S. and Canada, but it's on the rise in Europe, Africa, the Far East and South America. Seismic testing is about the same, but the magnetic method is increasing.

FRESH EVIDENCE of increased oil activity abroad is contained in a new report showing that geophysical exploration rose last year in the Eastern Hemisphere and in South America.

This contrasts with an earlier report showing a drop in geophysical prospecting in the U. S. and Canada (OGJ, Mar. 17, p. 176). However, the total amount for these two countries was still above that for the rest of the free world.

The 1957 exploration statistics on both hemispheres were gathered by the Committee on Geophysical Activity of the Society of Exploration Geophysicists, headed by Homer G. Patrick, Humble Oil & Refining Co.

Here are the salient facts in the report:

. . . **World-wide exploration** by geophysical crews decreased 1.2% in 1957, but this was due primarily to the domestic drop of 5.3% in the U. S. and 8.2% in Canada.

. . . **The Eastern Hemisphere** rose a healthy 15% over 1956.

. . . **The seismic method** of geophysical exploration just about held its own world wide, rising 0.15%. Reconnaissance exploration using the relatively inexpensive magnetic method shot upward 36.5% over its 1956 level. Exploration by gravity and other methods was down considerably.

Middle East . . . Surprisingly, the Middle East failed to keep pace with other Eastern Hemisphere areas, primarily because of a sizable decrease in the amount of gravity work.

Seismic prospecting, on the other hand, rose in the Middle East during 1957, while exploration by magnetic and other methods remained about the same.

Of the 428 crew-months of geophysical activity during the year, 262 were by the seismic method, 118 by gravity, 45 by magnetic, and 3 by other methods.

The greatest concentration was in Iraq, Turkey, and Saudi Arabia—a pattern set in recent years. Iraq had 120 crew-months of work, Asian Turkey 103, and Saudi Arabia 72. Iran's total was 38 and Kuwait's 9.

All geophysical work in the Middle East was handled by contract companies, except for a small amount in Turkey done by company-owned crews.

Europe . . . Geophysical exploration rose in Europe from 1,339 crew-months in 1956 to 1,592 in 1957. Germany and Italy had a good step-up in activity, while France had a smaller increase.

Seismic exploration accounted for 1,331 crew-months of the total for the year, magnetic 137, gravity 102, and others 22.

Germany was well in front of the other nations in total crew-months of activity—679 for all methods. Italy and Sicily had 314, France 219, Spain 68, and European Turkey 56.

Contract companies did 71% of the seismic work, 63% of the gravity work, and all the magnetic work during the year.

Africa . . . In Africa, one of the hot spots in current oil exploration, seismic exploration rose by 15% and gravity work by 20% in 1957. The total was 891 crew-months.

Libya was the busiest with 299 crew-months of geophysical activity. Algeria, Tunisia, and Morocco were lumped together in the statistics and had a total of 263. Nigeria had 70.

Contract companies did 76% of all geophysical work during the year.

Far East . . . A sizable increase in seismic crews boosted activity in the Far East well above the 1956 level. Magnetic prospecting also increased, but gravity work was down. The total for the area was 598 crew-months.

Pakistan was the leader with 141 crew-months, followed by Japan with 122, New Guinea with 91, Australia with 79, and Indonesia with 62.

As in Africa, 76% of geophysical work was done by contract companies.

The West . . . In the Western Hemisphere, South America had 15% more geophysical exploration than it had in 1956, while the U. S., Central America, and Canada fell below the 1956 level. Mexico was about the same both years.

South America had 973 crew-months of exploration, of which 279 were in Venezuela, 264 in Brazil, and 227 in Argentina.

Mexico had 267 crew-months of activity, and countries of Central America and the West Indies had 88.

Geophysical work in the U. S. and Canada, reported earlier, was down from 1956. The U. S. had 7,242 crew-months, off 7.8%.

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Harris Bill Needs Joint Help

. . . from all segments of industry to pass Congress, author tells Texas oil men. Bill would help to combat recession.

ONLY a "legislative miracle" could revive the near-dead Harris-O'Hara gas bill this year.

But miracles can be made to happen, Rep. Oren Harris (D-Ark.), cosponsor of the bill, told the oil industry in a talk prepared for the annual meeting of the Panhandle Producers and Royalty Owners Association at Amarillo, Tex.

Harris, a leader in the fight for the two bills that were passed by Congress and vetoed in 1948 and 1956, suggested a formula that might bring this to pass.

The field industries, he said, should quit their infighting and work together toward a policy "so obviously in the interest of our total economy."

And oil men should carefully avoid repeating the mistakes that led to the 1956 veto and this year buried the bill "some 9 ft. under."

"If and when we can and will join in pushing for its passage, Congress will act. Of that I am certain," Harris said.

How it helps . . . Prompt passage of the bill would serve two purposes, the congressman said:

. . . It would revitalize and stabilize the gas industry, in constant turmoil since the Phillips decision.

. . . It would provide a potent weapon for the fight against the recession.

A clear-cut federal policy on gas would eliminate uncertainty and give the industry confidence in the future, he said. Producers, pipelines and distributing companies would expand their operations.

Additional wells would be drilled, calling for increased tubular goods and labor. A billion dollars a year in capital outlays would be released.

"This would be an antirecession step that would cost the taxpayer nothing; it would be carried out entirely by private business funds," Harris said.

"Sooner or later something is going to have to be done with this (gas) problem," Harris declared. "It cannot continue to remain in the chaotic and uncertain status. It is too widespread and affected by the public interest to such a degree that the welfare of the nation will demand it. The longer it is postponed, the worse it will be for the welfare of the nation."

"But if the bill is revived at this session or even if it is postponed and considered later, the industry will be on trial, Harris warned.

"In all candor, you have been on trial before," he said. "To date I must say you haven't been doing too well."

Navy to Drill at Teapot Dome

. . . after long absence. Government requests bids for 50-well drilling program in move to prevent drainage.

THE NAVY Department will move this month to prevent further drainage of government oil from Naval Petroleum Reserve No. 3 in Wyoming (Teapot Dome).

Capt. A. S. Miller, director of naval oil reserves, will call for bids within the next 10 days or 2 weeks from operators willing to take over the drilling and production program.

The Government will bear all the costs. The operator will be paid off through a share of the profits from the oil produced. Drilling operations will be supervised at a newly opened office at Midwest, Wyo.

It is estimated that as many as 50 wells may be needed to protect the oil threatened by private wells just outside the boundary of the reserve. The wells will all be shallow, mostly in the 1,000-ft. range.

There are no figures on the amount of oil that may be recovered. Many experts, however, do not expect it to be very great. The 9,321-acre reserve, of which only some 3,000 acres is oil-bearing, once was estimated to contain 125 million barrels. Later, the estimate was cut to 8 to 10 million barrels.

Idle since 1927 . . . Teapot Dome broke into the news 36 years ago next month as part of the biggest scandals of the Harding administration. While the Government owned all of the land, vague claims clouded the title. These claims were bought up by the late Harry F. Sinclair at a cost of $1 million. Sinclair offered to turn them over to the Government for a lease.

The arrangement for Teapot Dome was similar to that for other reserves. The Government's royalty oil was to be exchanged for products and storage tanks, to be built, in the case of Teapot Dome, along the Atlantic seaboard.

A Senate investigation revealed that a "little black bag" containing $100,000 was delivered to former Interior Sec. Albert A. Fall as a loan from E. L. Doheny.

After lengthy legal maneuvers the leases on the reserve were recovered by the Government. The reserves were returned to the Navy Department, from which they had been transferred to Interior just prior to their leasing.

Operations in Teapot Dome were shut down at the end of 1927, and the field has since been idle. Some 3.5 million barrels of oil was produced under the lease.

Russia to Use Oil

as trade weapon in cold war. Big growth in exports likely.

SOVIET RUSSIA is aiming at the use of petroleum as a weapon in the cold war, Allen W. Dulles, director of the Central Intelligence Agency, warned last week.

Soviet ability to export oil is increasing, Dulles told the annual meeting of the U. S. Chamber of Commerce in Washington.

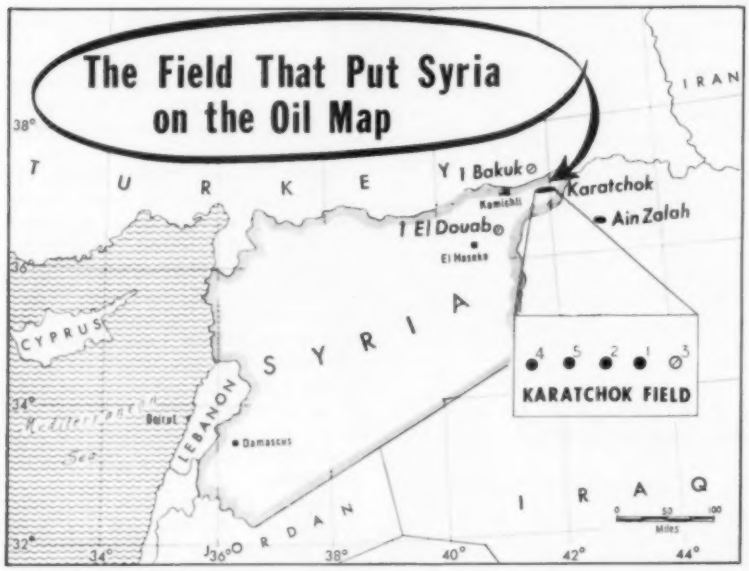
"By 1972 the Soviets plan to produce as much crude oil as we in the U. S. today. Even allowing for substantial increases in domestic consumption, they could export about 2,000,000 bbl. a day," he said.

"During the Suez Canal crisis we saw a brief glimpse of Soviet capabilities to grant or withhold economic favors through the form of its own petroleum exports.

"The increase in sales of metals and petroleum to free-world countries, which moved sharply upward in 1958, is not an economic flash in the pan. It is a reflection of growing Soviet industrial capacity."

Once the Soviets have made western European markets dependent on them for raw materials they will have a new and formidable weapon of economic warfare, Dulles said.

"By withholding supplies, by capriciously raising prices, or by dumping commodities, the Soviets in effect will have a seat at the council table of the great industrial nations of Europe," he told the chamber.



Syrian Field Impressive

. . . with fourth successful well now completed. Karatchok marketing plans still not definite.

SYRIA'S FIRST commercial oil field may prove to be extensive.

This is Karatchok (Kurdish for Black Mountain), discovered in 1956 by J. W. MenHall, Illinois independent, who was joined later by Atlantic Refining Co. and the Portsmouth Steel group.

The Karatchok operation and exploration now being carried on by a German company may be the only chance of Syria for private industry.

Hassan Jabara, Syrian planning minister, says any further oil exploration in the Syrian half of the new United Arab Republic (Egypt and Syria) will be carried out by the government. He says the government's work will not interfere with the two private operations.

Russian personnel and equipment will do the government work for Syria. The Russians will not have a concession, but will try to find oil for the Syrians under an economic aid agreement worked out early this year (OGJ Jan. 27, p. 141 and April 21, p. 109).

The field is located on a large-east-west trending anticline, big even by Middle East standards, at the extreme northeastern end of Syria in the fertile agricultural area between the Tigris and Euphrates rivers. It takes its name from a high basalt plateau well to the west.

The MenHall-Atlantic-Portsmouth Steel combine, with operations directed by MenHall, now is completing its fifth well at Karatchok. It becomes the fourth to be completed successfully flowing an average 500 to 700 bbl. of oil daily from a fractured limestone pay of Upper Cretaceous age topped at about 6,000 ft. All have been tested briefly, then shut in to await a market outlet.

The oil checks out at about 22° gravity. It is asphaltic, very viscous, and with a fairly high sulfur content.

There is other Cretaceous production in the Middle East—the closest in northern Iraq—but Karatchok oil is believed to be higher in the section than that in the northern Iraq fields.

Lots of pay . . . None of the wells yet drilled has gone through the limestone pay. But an average 200 ft. of it has been penetrated in each.

The five holes drilled so far are about 2 km. apart on a general east-west line along the structure (see map). And there is no evidence yet to show that drilling might be approaching an edge of the field.

The discovery well is the farthest east of the four producers. No. 2 was drilled 2 km. to the west, No. 3 is 2 km. east of the discovery, No. 4 about 4 km. west of No. 2, and No. 5 midway between Nos. 2 and 4.

No. 3, the only hole not a producer and the lowest structurally, was not dry as originally rumored but was temporarily abandoned at a shallow depth when operator "ran out of rig."

No. 4 on the west end of the line of wells is the highest structurally and found a substantial gas cap.

The gas supply may prove a boon in that the operators may later find it advantageous to artificially lift the oil. Due to the high viscosity of the crude, they feel that higher production rates likely would be obtained via artificial lift than by natural flow.

Conservative optimism . . . The M-A-P group is conservatively optimistic over Karatchok—terming results so far as "generally encouraging for further development."

Future drilling plans for the field are not yet known. And they may not be formulated until the group completes negotiations with the Syrian Government to convert its present exploration permits in the area to exploitation concessions. These talks are in progress.

The group holds, all told, 11 exploration permits covering about 770,000 acres in Syria's northeastern nose. MenHall and Atlantic hold nine of these on a 50-50 basis. Ownership of the remaining two is split with MenHall holding 50%, Atlantic 37.5%, and the Portsmouth interests 12.5%.

The field discovery was drilled on acreage included in one of these latter two permits.

Marketing plans . . . Likewise, concrete plans for marketing Karatchok crude haven't yet been finaled pending further development.

The field is a long way from any deep-water port on the Mediterranean. And a pipeline to the coast would be costly. It could not be undertaken until very large reserves were proved.

Thus, it is felt that the oil from the new field likely will go first to meeting Syria's local needs—later to help meet those of Egypt, now affiliated with Syria in the United Arab Republic.

Syria's biggest petroleum requirement presently is for diesel oil to fuel agricultural operations in the rich farm lands in the northeastern region—part of the ancient Fertile Crescent.

Some refining would be necessary

to manufacture this product from Karatchok oil. Later, demand for road oil in the country is expected to grow sufficiently to become an important factor.

Other operations . . . While Karatchok's production potential was being boosted, two wildcat operations by other groups in the general area were drawing attention—one in Syria, one across the border in Turkey.

Ste. des Petroles Concordia, the West German company, was nearing projected total depth in its El Bouab 1 deep test near El Haseke, Syria, about 75 miles southwest of Karatchok field.

At last report, drilling had progressed to about 10,000 ft. on a projected 11,000-ft. hole. No information has been released as yet on this test.

In Turkey, about 15 miles northeast of the Syrian border town of Kamichli and about the same distance northwest of Karatchok, the Tidewater-Atlantic-Seaboard group was down to about 4,000 ft. with its initial test in that area, the Bakuk 1.

This wildcat is being drilled, with Tidewater as operator, on what has been termed a major structure found by the group on a part of its 3,000,000-acre Turkish concession. Here, too, no drilling data is yet available.

Prize Iranian Plot Landed

. . . by Standard of Indiana. Competition for Persian Gulf concession was rife and the price came high.

AFTER NEARLY 30 years, Standard Oil Co. (Ind.) is going back to the Middle East.

A newly-formed subsidiary of the Indiana company has walked away with a prize concession of offshore Iran territory in the Persian Gulf in competition with more than 20 other companies.

The terms offered Iran by Pan American International Oil Co. startled the entire oil world.

Pan Am's deal is also a convincing proof of what oil men have known since Venezuela offered new concessions—they cost more than ever before and the price tags may get even bigger.

Making its reentry into Middle East oil stick, Indiana Standard followed the lead of the Italians in offering National Iranian Oil Co. a partnership deal. The American company added a $25-million bonus to an agreement which already gave Iran 50 per cent of the profits, plus another division of any oil income with its partner, the Iranian government company.

Pan Am International has agreed to spend $82 million on exploration in the first 12 years. NIOC will put up nothing.

For all this Pan Am gets a 16,000 sq. km. (almost 6,000 sq. miles) offshore concession along Iran's Persian Gulf Coast trending southeast from the concession already granted the Italians (OGJ, March 24, p. 104).

Reaction to deal . . . It is highly unlikely that Iran will get such terms for any of the remainder of its District 1 offshore territory. The concession granted Pan Am is considered the prize acreage in the district.

When Enrico Mattei's Italian Government company got its concession a year ago with the controversial 75-25 profit split offer, the proposal was pretty soundly denounced by American oil men.

A top executive of Jersey Standard called the Italian deal a gimmick to avoid paying a bonus for a concession.

Howard Page, the Jersey executive, said at that time his company would depend on a substantial bonus offer to win its concessions.

Last week, Pan Am's Italian-style partnership with NIOC—plus the $25-million bonus—was easily the top topic of all foreign-oil conversations.

Iran's premier, Manouchehr Eghbal, presented the agreement to his parliament with unrestrained jubilation. He called it a "masterpiece." Under Iran's new oil legislation the parliament must approve the agreement.

Sold early holdings . . . The joint venture with NIOC marks Indiana Standard's return to the Middle East after 27 years. The company sold its interest in Near East Development Corp. to Jersey Standard and confined itself to domestic production in the United States.

It has been only recently that the Indiana company returned to the Latin American oil scene after deciding to go into foreign oil again.

Pan American International, the company which made the deal with NIOC, was formed in February with C. F. Dohm, formerly head of Conorada Petroleum Corp., as its president (OGJ, Feb. 10, p. 76).

Gulf Drilling Set

by Pemex off Mexico. Work will start in week or two.

OCEAN DRILLING & Exploration Co. has been awarded contract by Petroleos Mexicanos for a multiple-well drilling program off the coast of Mexico.

ODECO's new drilling barge, the "El Dorado," will be towed to its first drilling location near the northern coast of the Isthmus of Tehuantepec about the middle of May.

The vessel, designed for drilling in 70-ft. water, is now nearing completion at the Mobile yard of Alabama Dry Dock & Shipbuilding Co., Inc.

The New Orleans-based contractor is said to have a turnkey job for four wells. It's anticipated that the contract will be extended if production is established.

Casing, drill pipe, mud, and other supplies for the first job are being purchased in the United States for shipment across the Gulf of Mexico. Drilling operations will be about 800 miles south of New Orleans.

Details of the drilling program have not been announced. It is understood that Pemex plans to test several major structures ranging about 15 to 20 miles off the coast.

Shell-BP Hits Two

more Nigerian discoveries. Finds made within 2 weeks.

SHELL-BP Petroleum Development Co. has made two more discoveries in its fast-moving Nigerian program.

The finds were made within 2 weeks of each other in eastern Nigeria. One is at Bomu, near Port Harcourt. The other, a small but encouraging discovery, was brought in near Calabar.

The company has found five fields in 21 years of exploration in the country. The last three were brought in this year. Besides Bomu and Calabar tests, a well below 10,000 ft. at Soku in the Niger River Delta was brought in after the turn of the year.

Oloibiri and Afam fields, the initial finds, are undergoing production tests with a combined output of 6,600 bbl. daily.

Shell-BP Petroleum will spend as much as $30 million on exploration this year. It will have 6 to 10 rigs in operation. The first of two drilling tenders has arrived, and a test is under way near Bonny Town in the mangrove swamp area of the Niger River Delta.

Congrats and $25 to J. E. ROBERTS, Sohio P. L. Co., 7438 Forsyth, St. Louis, Missouri.

Talk about team work . . . Lone Star Steel's folks always come through with plenty of API quality casing, tubing and line pipe for "coach" Joe Roughneck. Joe, symbolic heart of the oil and gas industry, knows that Lone Star is his dependable source of supply.

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"Our Fords carry more—cost less to

says V. M. Christianson, Superintendent of Maintenance, Petroleum Heat & Power Company Chicago, Illinois

"Our drivers find Fords much easier to Ford engines stand up best under daily

"We've got 25 Ford trucks—all equipped with tandem rear axles and power steering. Their maneuverability beats anything we've ever had. The conventional tractors are pulling 5000-gallon semi-trailers and we are using 4000-gallon tanks on the Tilt Cab straight-trucks.

"All of our Fords are equipped with 332-cubic inch V-8's that are running on considerably less gasoline than other engines in the same type of service. We are also very much pleased with the oil economy. I know of nothing harder on an engine than the daily pumping of fuel oil, and the Ford engines have proved as durable as they come. On city deliveries our Fords do more pumping than they do road miles.

"Drivers find the Fords are much easier to handle, particularly in highly congested city traffic. Our men like the Ford cab because it is easier to get in and out of—they feel fresher at the end of a day's run. We are going Ford because we feel we can't buy better for top performance, low-operating expense and low initial cost."

run than other makes we've owned"

The Ford trucks in the Petroleum Heat & Power Company fleet deliver fuel oil to both residential and commercial accounts in Chicago and its suburbs. The T-800 tractor *at the left* is grossing 64,000 lb. and the GVW of the C-800 trucks is 41,000 lb.

handle in traffic. stress of pumping!"

Whatever your business... there's a FORD truck for your special needs

Official registrations for 1957 show *Ford is first in sales to American business.* There are many reasons for this popularity . . . many reasons for *you* to make your next truck a Ford!

Ford trucks are your best buy, too! Ford's initial costs are *low* and resale value is traditionally high. The modern Ford Tilt Cab line is America's lowest priced. And Ford Styleside pickups are the lowest priced with full cab-wide body . . . giving you 23% more loadspace than any traditional type pickup box.

Only Ford offers the economy of Short Stroke power in all engines, Six or V-8. And Ford's Heavy Duty V-8's offer new, advanced durability features. The modern Ford Six, for Light and Medium Duty F-Series, offers a new carburetor for up to 10% greater mileage. It's plenty peppy too, with more horsepower per cubic inch than any other six in its class.

Ford's rugged cab and chassis construction means these new '58s are built to last. All this plus the proven fact that Ford trucks last longer adds up to America's No. 1 truck value.

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Tunisia Awards Acreage

. . . to Conorada with at least $4 million scheduled for exploration. SEREPT only other company with permits.

CONORADA PETROLEUM Corp. last week agreed to spend $4 million in the next 5 years looking for oil in west central Tunisia.

Negotiations with the Tunisian Government over terms of an exploration permit covering 28,356 sq. km. (10,948 sq. miles) have been going on for months. Final documents were signed in Tunis.

The agreement calls for a 5-year exploration, but the exploration period may be extended three times for 3-year periods. There is no annual rental other than the work obligation.

Discovery of commercial oil at any time during the exploration period will mark the beginning of a 50-year exploitation concession. Conorada would be obligated to surrender half its acreage holdings under a specified program of releases. At the end of the first 5 years, 20% must be given up. In 3 more years, the company can hold 64% of its original concession. At the end of the first 11 years of production, the original acreage must be cut in half.

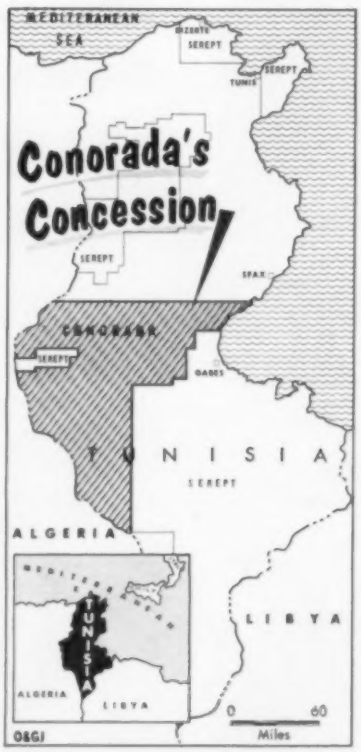
The agreement calls for the payment of 15% royalty to the Tunisian government with other taxes and duties making the standard 50-50 profit division between government and operating company officials during production.

Ben F. Uhl, Jr., Conorada president, said that geological and photogeological work on the permit area will start immediately (see related story, p. 181).

Other activity . . . Only one other company, a joint French-Tunisian concern, is now at work in the country.

Ste. de Recherches et d'Exploitation de Petroles en Tunisie (SEREPT) has three rigs running in the country on its southern holdings to the east of the new Conorada block.

SEREPT is 70% owned by the French Government and 30% held by Tunisia. The company has been unsuccessful in an intensive effort to find commercial oil on a total of more than 74,000 sq. km. of exploration acreage. Its only success to date has been the eight-well gas field at Cap Bon, southeast of Tunis. The field, discovered in 1948, produced about 700,000 cu. ft. of gas daily last month.



Output is piped to Tunis for local use.

Cie. des Petroles de Tunisie (CPDT), in which the Royal Dutch-Shell group had a 35% interest along with SEREPT, gave up all its 12,000 sq. km. of acreage nearly 2 years ago after an unsuccessful exploration program. CPDT's acreage was all in the northern half of Tunisia.

Red Visit Slated

at World Oil Congress to show technical know-how.

TOP-RANKING Russian oil men will visit the United States next year to attend the Fifth World Petroleum Congress, and possibly to startle the free-world industry with word of some new technical advance.

The number of Russian and Red satellite delegates is not yet known. But they are certain to be a center of interest among the 6,000 visitors from 47 countries.

A handful of visitors from the Russian industry stole the show at the 1955 congress with details of turbodrilling. Data revealed at the Rome meeting at first impression appeared to make conventional rotary drilling methods far outdated. Experiments are now being made in this country on the Russian-type equipment. But reports are that the techniques may be superior only in some types of formations.

The New York conference will be the likely time and place for announcing any more Sputnik-class developments achieved by the Russians. The purpose of the congress every 4 years is to give oil men a chance to talk shop and evaluate technical advances.

Second Zone Shown

by tests of Lake Maracaibo well. Prospects are better.

SIGNAL OIL & Gas Co. of Venezuela's fourth well on its 28,000-acre Lake Maracaibo concession is even better than excellent early tests indicated. It showed production can be expected from a second producing zone.

On a 1-hour test, the well, 4X Centro, flowed clean 43.4°-gravity crude at a 3,800-bbl. daily rate from the Eocene C-6 zone at 12,284-12,353 ft. Earlier, the well tested the C-2 zone at 10,044-10,200 ft. for 5,136 bbl. daily.

The well has logged about 600 ft. of oil sand which is either productive or has been tested successfully elsewhere in the area. Signal will test 4X Centro further before completion.

Signal of Venezuela operates the concession for Signal Oil & Gas Co., Hancock Oil Co., Pure Oil Co., and Standard Oil Co. (Ohio).

Two drilling rigs are currently active on the lease. The latest exploratory well is 5X Centro spudded April 25 on a location 4½ miles northwest of 4X Centro.

Peruvian Drilling Slated

TWENTY wells will be drilled in Peru by David M. Grubbs of Dallas and a group of Texas oil men under a contract with Amotape Oil Co.

Material for the first four wells already has been shipped by Mid-Continent Supply Co., Inc., to Talara, Peru. Amotape's properties are located along the Pacific shoreline 40 miles northwest of Talara.

Amotape now operates four producing wells through its subsidiary, Petrolera Amotape S.A. of Lima, Peru.

Aminoil Plans Refinery

. . . in Kuwait as part of Neutral Zone expansion. Work follows settlement of stockholder fight over management.

AMERICAN INDEPENDENT Oil Co. is pushing plans to build a refinery in Kuwait and expand its pipeline, storage, and terminal facilities following settlement last week of a 3-year-old dispute among stockholders.

Ralph K. Davies, president of Aminoil, announced the settlement. It ended litigation in San Francisco and Delaware courts among stockholders over management of the company, which has valuable holdings in the Kuwait-Saudi Arabia Neutral Zone.

Davies said "by clarification and compromise, complete and satisfying agreement has been reached and harmonious relationships firmly established."

The agreement called for:

. . . Creation of a board chairman's post which Davies will occupy as soon as a successor president has been selected by the board.

. . . Election of a president satisfactory to all factions to act as an "operating and managing head." The board chairman will devote his efforts to relations with foreign governments, new ventures, and financing.

. . . Pushing an expansion program by the company in the Middle East.

New president . . . Result of the agreement reportedly will be to give the majority stockholders, led by Phillips Petroleum Co., a chance to elect a candidate for president.

Phillips owns one-third of Aminoil. Four other stockholders allied with Phillips give this group 58% of Aminol's outstanding shares. Shareholders working with Phillips are Ashland Oil & Refining Co., J. R. Abercrombie, Houston oil man, Crescent Corp., and Sunray Mid-Continent Oil Co.

The legal battles stemmed from efforts of the majority group to set aside an agreement among stockholders prohibiting control of Aminoil by any one stockholder and putting Davies in as executive head.

The settlement was called a compromise between the Phillips group and the five smaller stockholders. The latter group included Globe Oil & Refining Co., Lario Oil & Gas Co., Hancock Oil Co., Signal Oil & Gas Co. and Davies.

The expansion . . . Aminoil holds the concession covering the Kuwait half interest in the Neutral Zone.

Getty Oil Co. holds the Saudi Arabian half interest in the zone. Production from the Neutral Zone approached 80,000 bbl. daily at the first of the year. It is split 50-50 between Aminoil and Getty.

Aminoil is planning a 40,000-bbl.-daily fuel-oil and crude stabilization unit at Mina Abdullah in Kuwait on the Persian Gulf. The plant will be similar to one Getty is building on the coast of the Neutral Zone at Mina Saud. It will not have a complete range of processing units nor a full line of products.

Design work is being done by Carroll Bradberry & Associates, Los Altos, Calif. Construction probably will be supervised by Arabian Bechtel, Ltd.

Aminoil plans to expand its pipeline facilities from Wafra field to Mina Abdullah where storage and terminal facilities also will be enlarged.

Algerian Future Is Looking Good

. . . with new Zarzaitine discovery. But a political hitch is proving to be a transportation barrier for the French.

IF POLITICS doesn't get in the way, a new oil discovery deep in the Sahara may prove to be almost as important to France as the much bigger oil field the French are feverishly developing in Algeria.

The new Zarzaitine find isn't as big as Hassi Messaoud, but it now appears to be more important than either Edjele or Tiguentourine, the Sahara's two first oil fields (See related story p. 91).

Here are some of the points in Zarzaitine's favor:

. . . Crude quality is just as high as that found at Hassi Messaoud, the field which has French government and oil circles so excited.

. . . Less cost to develop than the much deeper Hassi Messaoud field which found its pay at around 11,000 ft. requiring deep, expensive drilling.

. . . A higher recovery of oil in place seems certain than in the deep, tight sands at Hassi Messaoud.

. . . Proximity to shipping points is almost the same as in the big Hassi Messaoud field, but the logical and most economical route for a pipeline would take it through Libya or Tunisia. Here's where the political hitch comes in. French relations with Tunisia are particularly strained at the moment. Unless these can be smoothed over it is doubtful if the most logical pipeline route will ever be selected. A route through Libya to Tripoli on the Mediterranean would be just as logical, but it also would involve crossing an international boundary.

It's not likely that Libya would pose serious obstacles to such a line, in spite of its obvious sympathies toward the Algerian nationalists who are battling the French. But, whether or not the French would agree to such a project is still a question. French thinking with reference to North Africa has been influenced far more by emotion and nationalism than by reason in the last year.

The new field . . . Cie. de Recherches et d'Exploitation de Petrole au Sahara, owned 35% by the Royal Dutch-Shell group, completed its oil discovery at Zarzaitine a full 2 years after the company made the Sahara's first commercial discovery at Edjele.

CREPS is cautious now and refuses to make any predictions for its newest find. But, if future drilling bears out the promise of what has been found so far, it will be far more important than Edjele.

The discovery well, ZR 2, was the third test drilled on a well-pronounced surface structure about 30 miles north of Edjele in the extreme southeastern Sahara. The well flowed 3,200 bbl. daily of 43°-gravity crude from a 164-ft. pay topped at 4,350 ft. The pay is believed to be of Tournaisian age, a lower Carboniferous zone which corresponds to the Mississippian.

The discovery flowed with a tubing pressure of 280 psi. and a bottom-hole pressure of 1,780 psi. from a zone with far better permeability and porosity than any oil pay yet found in the Sahara.

Since that time a ¾-mile offset to the east, ZR3, found the same pay

Mr. Kenneth B. Barnes
Editor
The Oil and Gas Journal
Tulsa, Oklahoma, U.S.A.

Marseilles, France
Air Mail

Dear Kenneth:

Thank you for your kind note. Here is a recap of what has been happening at Hassi Massouad.

1 MD, the discovery, was brought in on the top of a deep-seated refraction high at Hassi Massouad. Nine wells are currently producing here. While 3 MD paid on test 7,300 bbl. daily, and 4 MD 5,840, the seven other completions average 1,800 bbl. daily. Four other tests have considerably boosted the areal extent of the proved pay--now put at 125 sq. miles--and local reserves. Most cautious estimates put such at 220 million bbl. These are capable of considerable upward revision--anything up to 7.3 billion bbl.--should the field extend in a northerly and easterly direction, as 81 OM and 5 MD seem to indicate.

Of average 43.2° API gravity, the paraffin-base local crude is of diesel-fuel quality as collected. After mere filtering, it goes to power the local rigs. It contains almost no sulfur, that bane of Middle-Eastern crudes, and yields by weight 43% of gasoline, 25% of fuel oil, 23% of middle distillates, the balance representing light distillates.

Thanks for the regular service of the O & G J. Let me tell you that it is by far the best in its field in the world.

Very truly yours,
M. Moyal
Maurice Moyal, Ph.D.

HASSI MESSAOUD is Algeria's biggest field to date. Above are Dr. Maurice Moyal's latest figures on the field's production and quality of crude.

about 150 ft. deeper at 4,513 ft. CREPS has released no test figures for the offset, but the company has moved its rig 2½ miles to the north for ZR4.

The first hole drilled on the Zarzaitine structure was 101 ZR which blew out after it encountered a whole series of Carboniferous gas zones. The second well, ZR1, tested 105,000 cu. ft. of wet gas an hour. Now CREPS believes both were drilled into the gas cap of a large oil-producing reservoir. The company believes that both ZR2 and ZR3 are on the producing flanks of this structure.

Both Edjele, discovered in January 1956, and Tiguentourine, found 45 miles to the northwest, have active water drives and irregular reservoirs with complicated tops. Porosity of the Carboniferous pay zones at Edjele range from 20 to 30% and about 20% at Tiguentourine. The deep Hassi Messaoud pay, some 275 miles to the northwest, averages less than 10% porosity, CREPS has released no porosity or permeability figures for Zarzaitine, but both are conceded to be much higher than at any of the other three fields.

At Edjele, the French-Shell company has already completed 23 wells, each capable of making from 150 to 250 bbl. daily with locations in staggered alternate rows on 80-acre spacing. Two more are now drilling.

Tiguentourine wells have tested from 25 to 32 bbl. an hour with large volumes of wet gas from several pays ranging from 2,600 to 4,600 ft. The best productive horizon is believed to be the shallower Visean, a lower Carboniferous zone. Thirteen producers have been completed at Tiguentourine and two more wells are drilling.

Pipeline problem . . . Located as it is, 550 miles south of the Algerian Mediterranean coast, this production is still only frustrating the French who need the oil.

Alternate routes for a pipeline to move the Edjele - Tiguentourine - Zarzaitine crude are heavily weighted with political problems. They are just about as knotty as the whole French problem in North Africa.

The logical and most economic route for a pipeline from this area would be to the northeast through either Tunisia or Libya. This route would take at least 200 miles less pipe than an all-Algerian line. Unless the strained relations between France and Tunisia are eased it is highly unlikely that such a line would be built to Gabes on the Tunisian coast. Approval of such a project would be political suicide for President Bourguiba of Tunisia, whose people want the French thrown out of the country.

A similar route through Libya to a point on the coast to the east of the Tunisian frontier might be easier to negotiate. The Libyans are just as sympathetic to the Algerian nationalists fighting France as are the Tunisians, but not quite so actively.

Jersey Standard already has a 500-bbl. daily discovery at Atshan east of the Edjele area in Libya and there is a concerted exploratory drilling program now under way in the Libyan desert. If oil companies find reserves in Libya, they might be interested in participation in a line that would serve both their fields and those on the Algerian side.

This sort of thing is part of the scheme which an American promoter is trying to sell the French. Bennie Bender, Shreveport, La., is trying to obtain a French contract to build an 18-in. pipeline to Tripoli on the Libyan coast. His original plan called for looping his line south from Hassi Messaoud to include the Edjele area before heading back northeast through Libya. The loop part of his scheme now appears to be out of the picture because the French have started on a 24-in. line from Hassi Messaoud north to Bougie in Algeria.

French officialdom apparently wants the Edjele area production hooked into this 24-in. line being built to serve Hassi Messaoud. It would take about 290 miles of pipe to join the two fields.

The French are reluctant to consider a pipeline carrying French oil which would cross international boundaries of either two North African nations which are sympathetic with the Algerians. The French reason that they would be in much better position to protect the line if it were all located in Algeria.

Fierce French nationalism and well-founded political fears may far outweigh the economics involved in building a pipeline to move the crude. Higher costs involved in meeting these political conditions may delay the project and keep the French from tapping another oil source.

EXPLORATION

THIS RIG is drilling on the promising Tin-Essameid structure southwest of Edjele. The well encountered a shallow gas deposit and blew out but was later brought under control. (Photo courtesy F. Nougarede, geologist, CREPS.)

Three good strikes boom prospects for Sahara Desert

BY DR. MAURICE MOYAL
Petroleum consultant, Marseilles

FRENCH OIL CIRCLES are in a tizzy over the recent sucesses in the Sahara Desert. To date three highly successful strikes have opened a vast area in the desert for possible oil and gas production. These are: Edjele, discovered in 1956; Tiguentoruine, brought in in June 1956, and now Zarzaitine. This last strike is hailed as the most significant in the eastern Sahara and one that could outshine Edjele.

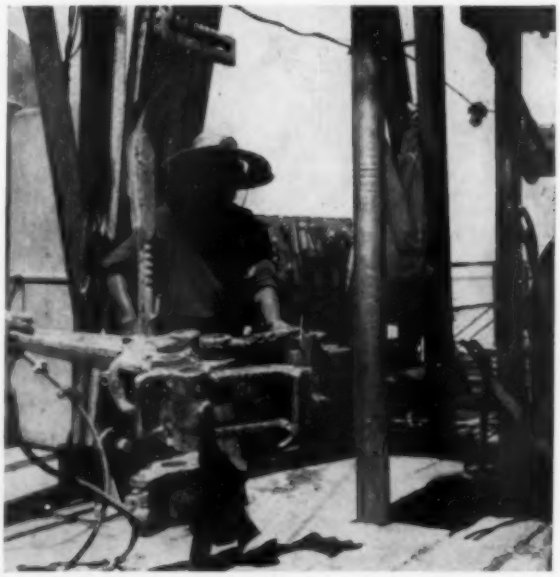
Zarzaitine . . . Surface geological work uncovered Zarzaitine, an almost heart-shaped surface structure. It lies 30 miles northwest of Edjele. The feature covers about 40 sq. miles and will soon be the scene of an intensive drilling campaign. Three wells have already been drilled on the prospect. The 101 ZR was spudded on a seismic high and blew out when it tapped a gas-bearing limestone. After the well was brought under control, it opened up a series of gas reservoirs of Carboniferous age. Interesting enough, the well was located on a topographic high as well as a positive gravity anomaly.

But the real payoff at Zarzaitine was the 2 ZR, located on the flank of the structure. This well logged a pay section 164 ft. thick, a sandstone probably of Tournaisian (Lower Pennsylvanian) age. The zone flowed 3,200 bbl. per day on drill-stem test and the crude has a gravity of 43.19° API. These tests also logged relatively large volumes of gas. The bottom-hole pressure in the 2 ZR is 1,780 psi. at a depth of approximately 4,000 ft. Commercial production was also established from an upper reservoir of Devonian age.

The oil reservoir is a sandstone that occurs within a marl sequence. The pay zone has an exceptionally high permeability and porosity indicating that the strike will be capable of a far higher ultimate recovery than is true of any of the other Saharan strikes to date. The marl has a high bentonite content and requires a mud with a density of 1.2 with a minimum water loss. The bentonite tended to slough during drilling operations and air drilling was tried but was not successful.

Three wells completed to date at Zarzaitine give the following stratigraphic column: Tertiary overburden up to 984 ft. thick rests on the Namurian limestones 490 to 660 ft. thick. These contain important gas reserves. Immediately below this sequence is a marl-sandstone Carboniferous series 2,600 ft. thick. The Carboniferous rocks contain a number of large gas reserves. These rocks rest

CREPS uses native helpers. These men can handle roughneck jobs, but none so far has been able to graduate to driller. (Photo courtesy Col. Nougenot, CREPS.)



LATEST of the Sahara strikes is Zarzaitine, a large surface anticline. The second well on the feature logged 164 ft. of oil-stained sand and flowed 3,200 bbl. per day on drill-stem test.

upon Lower Devonian formations of undetermined thickness.

Officials of CREPS (Compagnie de Recherches et d'Exploitation de Petrole au Sahara) have cautiously refrained from overemphasizing the importance of the new strike. Field representatives, however, are more jubilant and claim that the new pool will surpass Edjele.

Edjele

The first commercial oil production in the Sahara was tapped at Edjele, 6 miles from the Libyan border and 175 miles east of Fort Flatters. The initial test on the Edjele structure was staked after core drilling the surface feature. Spudded in December 1955, the discovery logged two oil pays. On production tests, the well flowed 500 to 600 bbl. per day of 35° API crude from the interval 1,378-1,476 ft. In addition, the wildcat logged oil shows at 1,600 ft. and gas shows at 2,156 ft. This was the first commercial oil strike in the Sahara Desert.

Subsequent drilling has shown that Edjele has an irregular reservoir and that a main fault on the east flank of the structure has some influence on production. At least five separate commercial reservoirs have been tapped; three sands of Carboniferous age and two deeper zones, possibly Devonian. In addition, a sixth sand (Carboniferous) has had promising oil and gas shows and may be commercial.

To date 23 wells have been completed at Edjele and two tests are under way. CREPS is developing the field on 80-acre spacing for the upper section, the three sands of Carboniferous age, while a similar pattern has been followed for the lower pay section (the two deeper Devonian zones). Two wells were purposely drilled on the flank of the structure to ascertain the oil-water contact. The remaining 21 wells are currently averaging 150 to 250 bbl. per day. Engineers estimate that the Edjele structure will require at least 500 wells to insure ultimate recovery of the estimated 773 million barrels in place.

The Edjele crude has a paraffin base (Table 1).

TABLE 1

Density	0.848
Gravity, °API	36
Viscosity (Engler at 20° C.)	1.76
Pour point, ASTM, °C	—63
Fire point (Luchaire LVF), °C	—17
Flash point (Luchaire LCF), °C	—15
Water, per cent	nil
Sediments, per cent	nil
Sulfur, per cent	0.06
Paraffin, per cent	2.3
Salt, per lb.	0.0014

Tiguentourine

Seismic work confirmed the Tiguentourine gravity anomaly that lay 45 miles northwest of Edjele. The initial test, 101 TG, was spudded in June 1956 at the crest of the northern closure on the Tiguentourine structure. The test logged promising oil shows in a sandstone series and established commercial production in a pay zone at about 1,680 ft. The second test, 102 TG, 1¼ miles southeast of the discovery, did not tap the same pay, indicating that the pool has other productive horizons.

Subsurface data from this well showed that the crest of the structure lay farther north and 103 and 104 TG were drilled as northern and western offsets to 102 TG. These wells established the regional extent of the deeper horizons. On drill-stem tests the 103 flowed 32 bbl. of oil per hour.

Tiguentourine crude is of better quality than that from Edjele. By weight it contains 43% automotive gasoline contrasted to Edjele's 26%. Its API gravity is slightly higher, and its shrinkage ratio is considerable. The local crude at Tiguentourine is very volatile because of its high butane and propane contents.

Several pays . . . The Tiguentourine anticline has three separate domes with the high point at In Tiraft. Two tests have established gas and oil reservoirs in the Lower Devonian and Tournaisian (Lower Pennsylvanian) on the north dome in a zone at 4,556-4,615 ft. tested 25 bbl. of crude per hour. Another interval between 2,943-5,212 ft. yielded 300,000 cu. ft. of wet gas.

Thirteen completions have been brought in to date and two tests are now under way. Two wells on the northern structure and one on the central part of the anticlinal trend were deep tests and provided geological information about gas reservoirs and the gas-oil contacts. Two wells

on the flank of the structure were purposely drilled into salt water to locate the oil-water contact. The main pay at Tiguentourine occurs at about 2,500 ft. and is Visean (Mississippian) in age.

Tiguentourine has an active water drive and the bottom-hole pressure ranges from 1,164 to 1,184 psia. Porosity of the sandstone is 20% compared to Edjele's 20-30%. Tiguentourine is not considered as important a discovery as Edjele by French engineers.

The properties of the local crude vary greatly from horizon to horizon, and it is difficult, if not impossible, to distinguish the individual pays from well to well. This is also true in other Middle Eastern fields such as Kuwait.

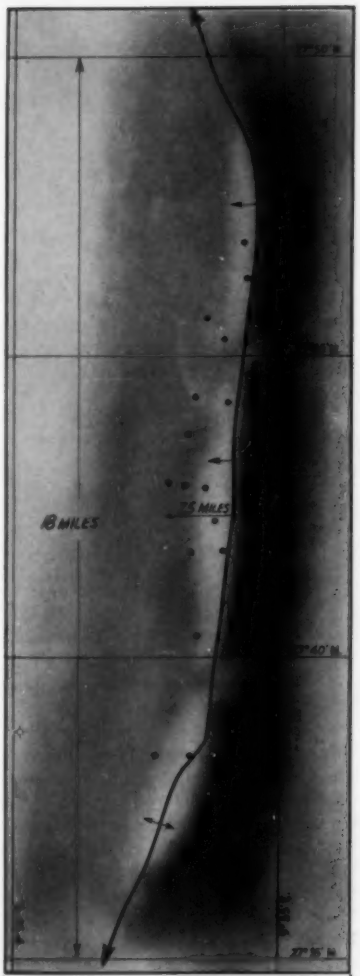
Huge trend . . . Tiguentourine has not been completely defined, but it is a north - northeast - south - southwest trend 50 miles long with at least three separate closures. Sand dunes conceal nearly two-thirds of this great trend, and these seriously hamper exploration efforts. Currently CREPS is drilling a series of core holes for geological information and to establish the boundaries of the productive area. On the northern feature there is a structural difference of 492 ft. between the two crests. There is a main fault on the steep east flank.

The less-important middle structure is 10 miles long and 5 miles wide. It is separated from the most southeasterly structure discovered to date by 120 miles of sand dunes.

Concessions . . . CREPS was formed April 13, 1953, and is owned by the Shell group and French Government companies. Shell controls 35% of the stock; the remaining 65% is split up among RAP, SOGERAP, SN REPAL, COFIREP, and FINAREP, with the first two named holding 25.5% each.

Here are the concessions now owned by this venture:

- The 1,080-sq. mile El Hobre exploration permit, northwest of Hassi Messouad, awarded this year.
- The 2,400-sq. mile Takouazet concession, in eastern Sahara, granted last year.
- The two adjoining Agueiba and Azzel Matti leases, aggregating 7,899 sq. miles in deep south-central Sahara, obtained in 1956.
- The hardby Aoulef, Djebel el Beida, Djebel Idjerane and In Salah, covering originally 36,000 sq. miles when granted in 1953, and making up with the above acreage a single block, known as the western "perimeter."



Edjele

. . . hundreds of millions of barrels?

This huge oil structure is illustrative of what the French are doing in the Sahara:

SIZE—18 miles long, 2½ miles wide.

WELLS—25 producing or nearing completion.

RESERVES—Unknown at present. However, even a modest 3,000 bbl. per acre would make total over 100 million barrels.

- The Issouane, Tadjentourt and Zarzaitine leases, covering 20,500 sq. miles when granted in 1953, and making up another block with the Takouazet lease, known as the "eastern perimeter," close to the Libyan border.

Under the terms of its concession agreements, CREPS had to release 28,330 sq. miles on March 11, 1958. This represents half of its 56,600 sq. miles of original acreage. This acreage will probably be gobbled up by other oil companies in view of the high interest in the Sahara.

This same sequence of events occurred recently when SN REPAL and CFPA relinquished half of their 24,000 sq. miles around Hassi Messaoud, the significant deep discovery in the middle of the Sahara. These anticipated awards will mark the second large-scale entry of foreign interests into the Sahara in partnership with French ventures.

Four geological basins . . . CREPS concessions fall in four geological basins. From west to east these are: the gas-bearing Azzel Matti; the Ahnet and Aguemour basins, and the Fort-Polignac unit. Edjele, Tiguentourine, and Zarzaitine all fall in the Fort-Polignax unit. All these basins were formed by tectonic movements that involved the Hoggar Mountains. These mountains are composed of crystalline and metamorphic rocks.

Surface geology possible . . . These forbidding stretches of the Sahara are devoid of water and vegetation and are remote from normal oil markets. However, they do have an advantage over other Middle Eastern ventures since they are closer to the western Mediterranean and the rapidly expanding European market. This partly offsets the geographical drawbacks.

The whole southern edge of the four basins listed above contains surface structures. As a result the area is readily accessible to surface reconnaissance. Along the southern edge, likely drill sites can be pinpointed far more quickly and at less expense than in the rest of the Sahara. In the area north of the In Salah parallel geophysical work is necessary to pin down structures concealed beneath sand dunes and other recent sediments.

During 1952 and 1953 the National Geographic Institute conducted an aerial photo survey for CREPS that covered both the western and eastern perimeters of the Sahara. This preliminary exploration work resulted in a photogeological map that outlined several possible structural traps.

First gas strike . . . The Djebel Bergha anticline was selected for test fol-

WELLS AT EDJELE are completed flowing. Here we see 104-DL during test. Wine bottle in foreground was used to catch an oil sample after first being emptied of its contents. (Photo courtesy F. Nougarede, geologist, CREPS.)

lowing surface reconnaissance work of the western block. This structure lies in the center of the Ahnet basin, 50 miles southwest of In Salah. The test, spudded in December 1953, encountered a series of porous, gas-bearing limestones of Lower Devonian age. Total depth on the well was 8,459 ft. A drill-stem test in the open hole flowed 21.75 M.c.f. of dry gas per day. This was the first positive evidence of the existence of commercial hydrocarbons in the Sahara, and also confirmed the geological opinion with respect to the potential pay zones.

Additional gas production was uncovered in the Ahnet basin in 1955. Djebel Djoua had gas production at 7,494 ft. in a tight limestone. At En-Bazzene the quartzite series at 7,793 ft. also carried gas. And at Oued Djaret a quartzite series also produced gas at 9,074 ft. In 1956 four other gas wells were completed at about the same depth and from the same formations at Tibaradine, Kreb el Douro and at No. 2 Djebel Bergha. These tests proved conclusively the presence of gas in the Lower Devonian and established other pays in the transition section from the Lower Devonian to the Gothlandian (En Bazzwnw and Tibaradine) and in the Ordovician (En Bazzene and Zini).

Test wells (1 Djaretand 1 Tiremouchine) proved that the Khrenig and Tournaisian sandstones were also gas bearing.

Additional gas reserves . . . Because the Ordovician was a likely drilling objective, CREPS set up tests on structures where the Lower Devonian was present beneath relatively shallow overburden. Ordovician gas production was established at Thara, Mouhadrine, Mahbes Guenatir, and Djebel el Mouima. However, the producing zones are tight and the biggest gas well produces only 8,750,000 cu. ft. per day.

Promising oil shows were also logged at Ghour-Bou Khrenis, Thara, Mouhadrine, Oued Djaret, and in the Tidikelt area.

Preliminary estimates indicate that already CREPS has established a gas reserve on the order of 7.04 trillion cubic feet and there are several other promising gas structures in the general area. Unfortunately, however, the discoveries have been dry gas, and this restricts considerably their importance. Nevertheless, there is at least a 50-year supply of gas for North Africa, and these reserves may well give birth to a new petrochemical industry. The strikes are over 900 miles from the main industrial consumers at Algiers and Oran, and no development drilling is planned on these strikes in the near future.

Fort Polignac Basin

Surface geology surveys were undertaken along the "eastern perimeter" in January 1954. Geologists were able to map a number of large structural traps which conceivably could harbor large oil or gas reserves. Surface parties encountered traces of the existence of oil on the eastern flank of the Edjele structure and in the Zarzaitine cliff. The sediments in the Fort Polignac basin are apparently of shallow water or littoral rocks. The sea covered the basin and extended toward the Hoggar range during the Silurian. At the end of the Silurian, the Talagrouna mole emerged.

The Ordovician rocks are presumably sandstones and range in thickness from 112 to 980 ft. These are fissured and several shallow core holes encountered an oil-bearing horizon.

During the Lower Devonian, vast masses of sandstones were laid down. These reach a thickness of 1,270 ft. in the south, thinning to some 300 ft. along the extension of the Talagrouna mole at Edjele and Zarzaitine. In these fields two and sometimes three pay zones have zeen identified as Lower Devonian.

Carboniferous . . . Toward the beginning of the Carboniferous, a Tournaisian sea covered the basin. Intermittent seas during Upper Carboniferous account for the interbedded sandstones and shales. Four of these layers are oil-bearing and geologists conclude that this crude was formed on the spot or very near the point of accumulation through the decay of organic sediments.

This Colennia reefs form the "eggshell" or rimrock at Edjele and Tiguentourine. These reefs lie buried beneath the Namurian continental marl and the marls in turn are covered by Triassic continental sandstones.

The Zarzaitine plateau was covered with sediments of Jurassic and Lower Cretaceous age and these rocks are principally lacustral in origin. Subsequently the plateau was covered by a sea and finally emerged toward the end of the Tertiary.

The Fort Polignac basin has been subjected to crustal movement over a long period of geologic time. The result is a series of more or less parallel folds that now can be mapped on the surface. Along the border area there are many promising structures such as: Talagrouna, Oued Amasrald, Daia, In Herene, Ti Talouine, Oued Tissit, Djebel Tardert, and finally the Edjele and Zarzaitine traps.

CREPS has used gravity and magnetometer surveys as well as two seismic crews to supplement and expand the original surface geological work. Gravity surveys outlined several areas of interest, among them: Gara 610, Tadjentourt, and NW Issendjel areas as well as the structures at Issouana and at Tiguentourine.

Here's some new thinking on how to establish

Pumping-unit requirements

The authors believe that general agreement on the maximum desirable rod stress would permit standardization of beam and structural capacities independent of the methods used in designing sucker-rod installations.

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Humble Oil & Refining Co.

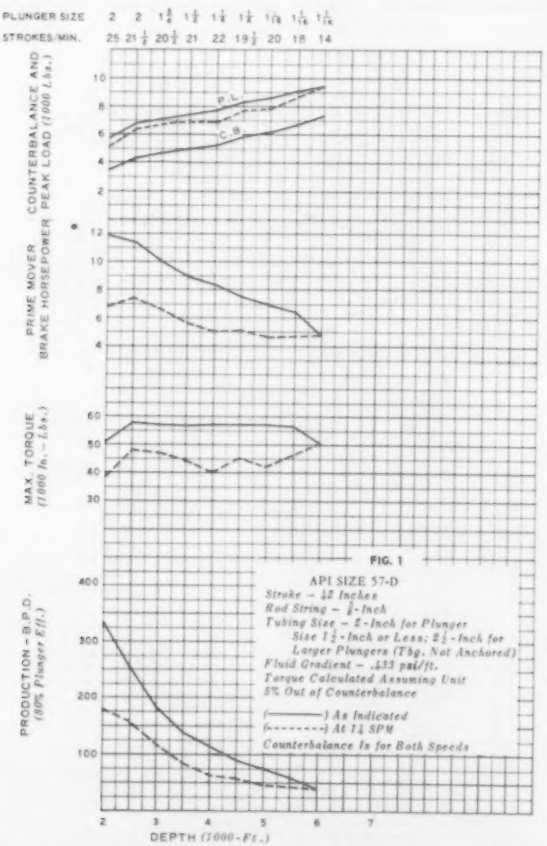
THE EQUIPMENT used to produce an oil well by sucker-rod lift should be sized to the well's ability to produce. However, if this information is not definitely known, economy in the selection of a pumping unit can still be realized if the component parts of a sucker-rod system are designed consistent with the weakest link.

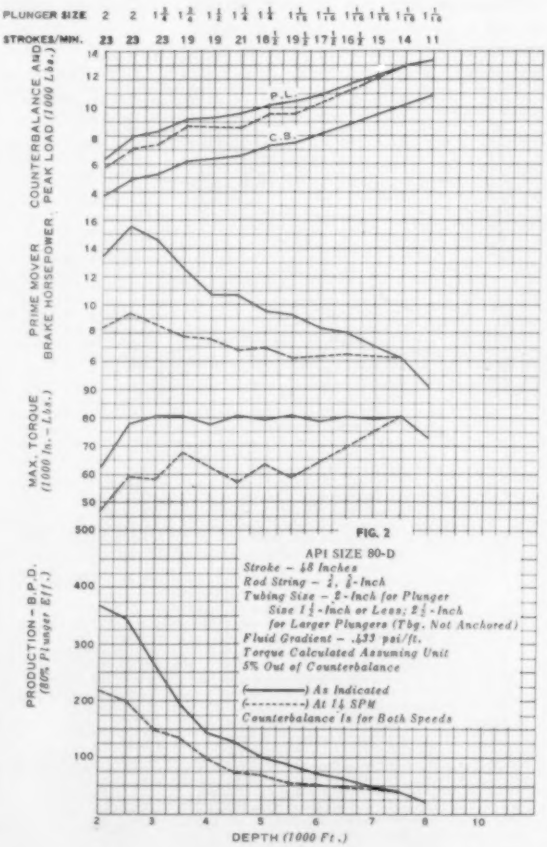
To obtain maximum production with a given combination of gearbox, stroke length, and rod size, the gearbox is the limiting factor for shallow and intermediate depths, and the rod string is the limiting factor for the greater depths. With this thought in mind, it is apparent that for each rod size there is a maximum structural capacity that can be utilized. Also, there is a minimum counterbalance that will permit full utilization of the beam capacity without overloading the gearbox; there is a maximum counterbalance effect that can be utilized for a given beam capacity.

Paper presented at spring meeting, Southwestern District, API Division of Production, Fort Worth, under the original title, "Method of Establishing Pumping-Unit Requirements."

Characteristic curves for given combinations of gearbox sizes, stroke length, and rod design which show the changes in producing capacity and equipment requirements with depth can be of great benefit in selecting pumping units with maximum utility and economy.

An analysis of this type, together with the limitations imposed by tubing and rod size, should be considered in any additional pumping-unit standardization work to determine de-


PLUNGER SIZE 2 2 1¾ 1½ 1¼ 1¼ 1¼ 1¼ 1¼ 1¼
STROKES/MIN. 25 21½ 20½ 21 22 19½ 20 18 14
COUNTERBALANCE AND PEAK LOAD (1000 Lbs.)
P.L.
C.B.
PRIME MOVER BRAKE HORSEPOWER
MAX. TORQUE (1000 In.-Lbs.)
PRODUCTION - B.P.D. (80% Plunger Eff.)
DEPTH (1000-Ft.)
FIG. 1
API SIZE 57-D
Stroke – 42 Inches
Rod String – ⅞-Inch
Tubing Size – 2-Inch for Plunger Size 1½-Inch or Less; 2½-Inch for Larger Plungers (Tbg. Not Anchored)
Fluid Gradient – .433 psi/ft.
Torque Calculated Assuming Unit 5% Out of Counterbalance
(———) As Indicated
(- - - - - -) At 14 SPM
Counterbalance Is for Both Speeds


PLUNGER SIZE 2 2 1¾ 1¾ 1½ 1¼ 1¼ 1¼ 1¼ 1¼ 1¼ 1¼ 1¼
STROKES/MIN. 23 23 23 19 19 21 18½ 19½ 17½ 16½ 15 14 11
COUNTERBALANCE AND PEAK LOAD (1000 Lbs.)
P.L.
C.B.
PRIME MOVER BRAKE HORSEPOWER
MAX. TORQUE (1000 In.-Lbs.)
PRODUCTION - B.P.D. (80% Plunger Eff.)
DEPTH (1000 Ft.)
FIG. 2
API SIZE 80-D
Stroke – 48 Inches
Rod String – ⅞, ¾-Inch
Tubing Size – 2-Inch for Plunger Size 1½-Inch or Less; 2½-Inch for Larger Plungers (Tbg. Not Anchored)
Fluid Gradient – .433 psi/ft.
Torque Calculated Assuming Unit 5% Out of Counterbalance
(———) As Indicated
(- - - - - -) At 14 SPM
Counterbalance Is for Both Speeds

THESE CURVES and those in the following six figures are helpful in the rapid selection of pumping-unit requirements. Plunger size and speed for a particular depth are optimum, and the curves were calculated to show maximum production.

sirable beam capacities, maximum stroke lengths, and counterbalance. General agreement among users on the maximum allowable rod stress would permit standardization of beam and structural capacities independent of the methods used in designing sucker-rod pumping installations.

The problem . . . Designing a sucker-rod pumping installation involves the selection of both surface and subsurface equipment which will allow oil to be lifted throughout the life of a well with a minimum initial investment cost and minimum operating costs. Selection of equipment should be such that overdesign does not result in a higher-than-necessary investment, yet will provide maximum flexibility in meeting the ultimate requirements for the well or possibly those of a second well.

The problem of achieving this optimum design is one of applying minimum safety factors in the design calculations; because, in addition to the safety factors which may be inherent in the formulas that are used, there are three additional sources of safety factor which may result in the application of equipment that is larger than necessary.

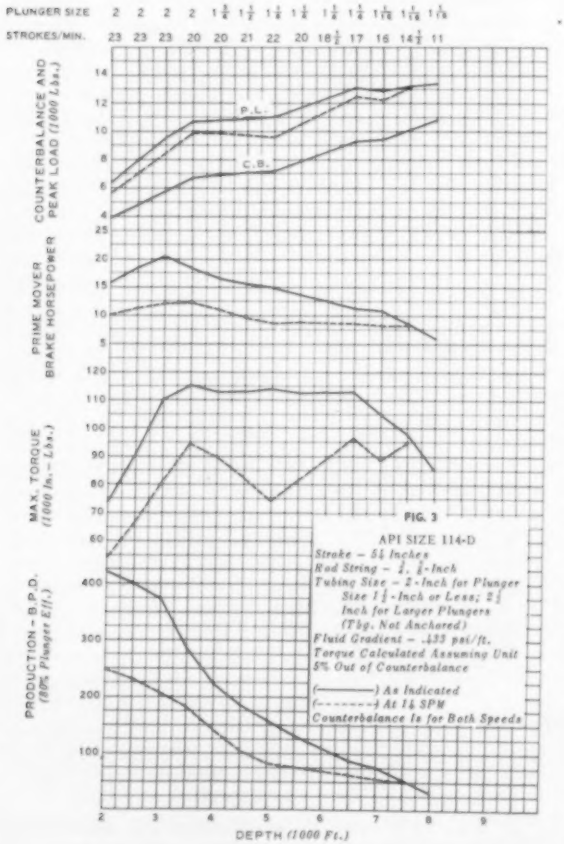
These sources are a result of designing an installation to: (1) lift more fluid than the well will produce or than is necessary to produce the allowable; (2) lift the desired fluid volume from a depth greater than that which is necessary; and (3) lift a fluid which has an average specific gravity greater than actual conditions. These factors, of course, depend upon the individual well characteristics.

Factors involved . . . With or without an accurate knowledge of a well's producing characteristics, there are certain factors which should be considered if maximum economy in unit selection is to be obtained. The upper limit of unit design should be based on the rod string selected; i.e., select a unit with adequate beam capacity to utilize the rod string to the maximum stress considered practical, and no more.

Counterbalance effect, through the adjustment of weights, the addition of auxiliary weights, or the exchange of master weights on the crank, should be available to permit counterbalancing the unit when the beam rating is fully utilized. Most manufacturers have recognized the need for this flexibility. They offer cranks that accept several master weight sizes or permit the addition of one or two sets of auxiliary weights as required. The combination of stroke length and gearbox torque capacity should be such that the gearbox can be adequately loaded at some point during the life of the well. Gearbox design should permit the use of a unit sheave large enough to operate the unit at the slowest desired speed while using a prime-mover sheave no smaller than that recommended for the V-belt section to be used. In short, the over-all unit design should be consistent with the rod string.

Certain dimensional limitations serve as helpful guides in the selection of pumping units. If 2-in. tubing is used, ⅞-in. rods with slim-hole couplings are the largest-size rods that can be run; and if 2½-in. tubing is used, 1-in. rods are the largest size that can be run. Where rod insert pumps are to be used, the maximum-size pump bore that can be run in 2, 2½, and 3-in. tubing is 1½, 2, and 2½-in., respectively.

Rods . . . Experience has indicated that carbon manganese and nickel molybdenum rods give good service under noncorrosive conditions when the rod stress is held below 30,000 psi. Above this stress, an increase in the frequency of rod failures often result. When a


PLUNGER SIZE 2 2 2 2 1¾ 1½ 1¼ 1½ 1½ 1¼ 1¼ 1¼ 1¼ 1¼
STROKES/MIN. 23 23 23 20 20 21 22 20 18½ 17 16 14½ 11
COUNTERBALANCE AND PEAK LOAD (1000 Lbs.)
P.L.
C.B.
PRIME MOVER BRAKE HORSEPOWER
MAX. TORQUE (1000 In.-Lbs.)
PRODUCTION - B.P.D. (80% Plunger Eff.)
DEPTH (1000 Ft.)
FIG. 3
API SIZE 114-D
Stroke – 54 Inches
Rod String – ¾, ⅞-Inch
Tubing Size – 2-Inch for Plunger Size 1½-Inch or Less; 2½ Inch for Larger Plungers (Tbg. Not Anchored)
Fluid Gradient – .433 psi/ft.
Torque Calculated Assuming Unit 5% Out of Counterbalance
(————) As Indicated
(- - - - - -) At 14 SPM
Counterbalance Is for Both Speeds

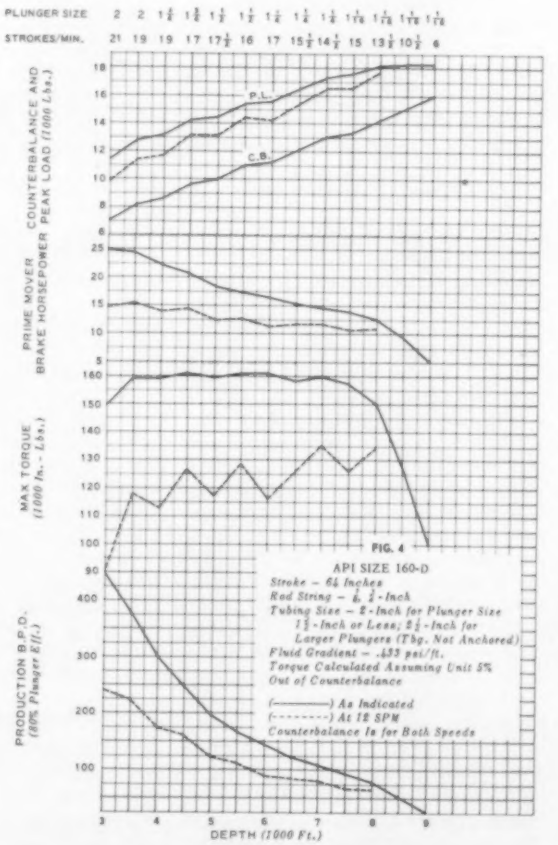

PLUNGER SIZE 2 2 1¾ 1½ 1½ 1½ 1¼ 1½ 1¼ 1¼ 1¼ 1¼
STROKES/MIN. 21 19 19 17 17½ 16 17 15½ 14½ 15 13½ 10½ 6
COUNTERBALANCE AND PEAK LOAD (1000 Lbs.)
P.L.
C.B.
PRIME MOVER BRAKE HORSEPOWER
MAX TORQUE (1000 In.-Lbs.)
PRODUCTION B.P.D. (80% Plunger Eff.)
DEPTH (1000 Ft.)
FIG. 4
API SIZE 160-D
Stroke – 64 Inches
Rod String – ¾, ⅞-Inch
Tubing Size – 2-Inch for Plunger Size 1½-Inch or Less; 2½-Inch for Larger Plungers (Tbg. Not Anchored)
Fluid Gradient – .433 psi/ft.
Torque Calculated Assuming Unit 5% Out of Counterbalance
(————) As Indicated
(- - - - - -) At 12 SPM
Counterbalance Is for Both Speeds

TABLE 1—BEAM CAPACITY REQUIRED BASED ON ROD STRESS

Nominal rod size (in.)	Nominal area, sq. in.	Beam capacity, lb. 28,000 psi.	30,000 psi.	33,000 psi.
⅝	0.307	8,600	9,200	10,100
¾	0.442	12,400	13,300	14,600
⅞	0.601	16,800	18,000	19,800
1	0.785	22,000	23,600	25,900
1⅛	0.994	27,800	29,800	32,800

maximum desirable rod stress has been established, the maximum desirable rod load and beam requirement are also established. Table 1 shows maximum beam capacity required to fully load the various rod sizes at three different stresses commonly used by various operators.

Two significant points should be noted from this table: (1) there is only a 15% variation between the high and low values being used, and (2) since the API has adopted five rod sizes, the table results in five beam classifications for each maximum stress.

The above tabulation does not include high-tensile rods. However, an informal poll of major rod manufacturers' representatives indicates that carbon manganese, intermediate alloy, and nickel molybdenum rods constitute 90 to 97% of rod sales. This suggests that, if agreement could be reached among the users on the maximum permissible rod stress either through discussion or through the work of the API Task Group on Corrosion Fatigue, standard beam capacities on API pumping units might be possible. The fact that 7 pumping-unit manufacturers show 39 different combinations of beam capacity and maximum stroke lengths in their catalogs for a 160-D unit, indicates that some degree of additional standardization is desirable.

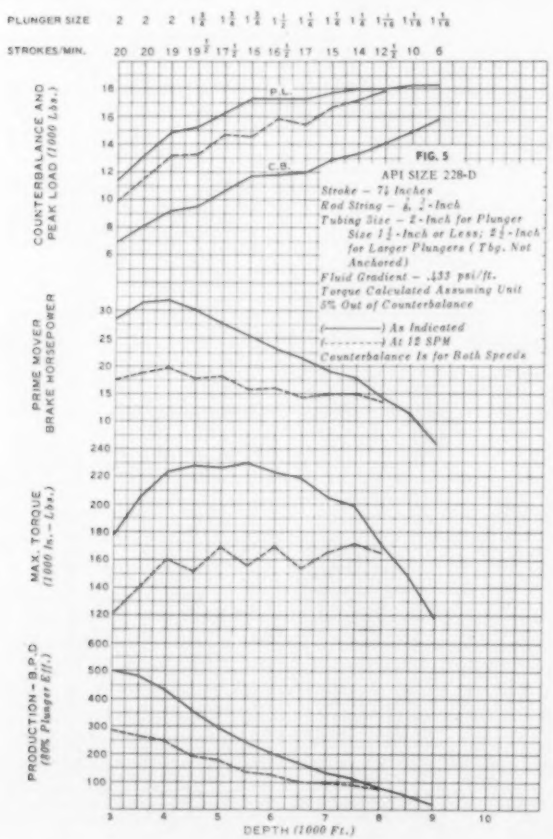
Gearbox load . . . The maximum permissible unbalanced load on the gearbox defines the minimum counterbalance effect required if the structure is to be loaded without overloading the gearbox. Table 2 shows the permissible unbalanced load for several gearbox sizes and common stroke lengths. Values shown in this table were obtained by dividing the gearbox rating in inch-pounds by one-half the stroke length. An examination of Table 2 will show that a 48-in. stroke 80-D unit has a maximum permissible unbalanced load of 3,330 lb.; therefore, if this unit had 8,000 lb. of counterbalance, the maximum beam capacity that could be utilized is 11,330 lb., the sum of the two values.

TABLE 2—MAXIMUM PERMISSIBLE UNBALANCED LOAD

API reducer size	Stroke length (in.)	Maximum permissible unbalanced load, lb.
57-D	42	2,720
80-D	48	3,330
114-D	54	4,220
160-D	64	5,000
228-D	74	6,160
320-D	84	7,620

Counterbalance . . . Assuming the beam rating was selected on the basis of a 30,000-psi. rod stress, Table 3 shows the minimum counterbalance effect that will permit loading the rods and structure without overloading the gearbox. Also, this table shows the maximum counterbalance effect that can be utilized on the unit as determined from the graphs in Figs. 1-8.

Counterbalance effect less than the minimum counterbalance shown in Table 3 means the beam and rods cannot be fully loaded in the maximum stroke position without overloading the gearbox; counterbalance capacity less than the maximum usable counterbalance shown in Table 3


PLUNGER SIZE
STROKES/MIN.
COUNTERBALANCE AND PEAK LOAD (1000 Lbs.)
PRIME MOVER BRAKE HORSEPOWER
MAX. TORQUE (1000 In.-Lbs.)
PRODUCTION - B.P.D. (80% Plunger Eff.)
DEPTH (1000 Ft.)
P.L.
C.B.
FIG. 5
API SIZE 228-D
Stroke – 74 Inches
Rod String – ⅞, ¾-Inch
Tubing Size – 2-Inch for Plunger Size 1¼-Inch or Less; 2½-Inch for Larger Plungers (Tbg. Not Anchored)
Fluid Gradient – .433 psi/ft.
Torque Calculated Assuming Unit 5% Out of Counterbalance
(————) As Indicated
(- - - - - - -) At 12 SPM
Counterbalance Is for Both Speeds

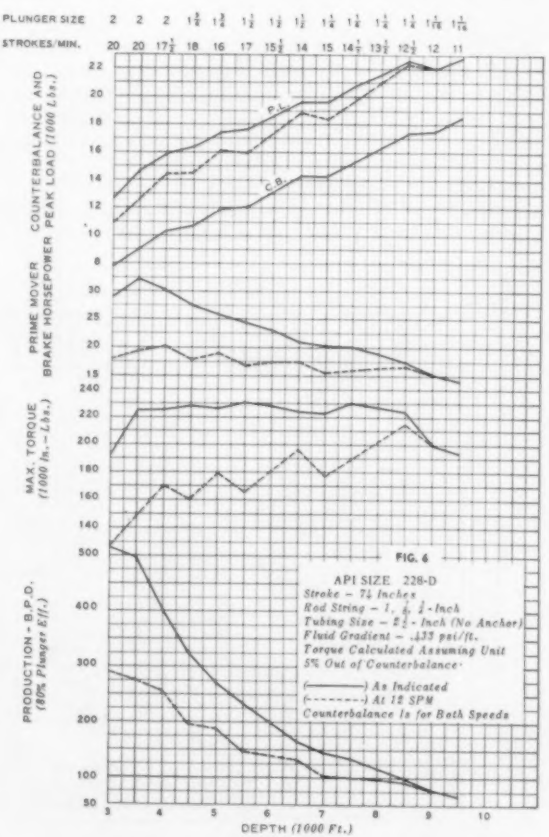

PLUNGER SIZE
STROKES/MIN.
COUNTERBALANCE AND PEAK LOAD (1000 Lbs.)
PRIME MOVER BRAKE HORSEPOWER
MAX. TORQUE (1000 In.-Lbs.)
PRODUCTION - B.P.D. (80% Plunger Eff.)
DEPTH (1000 Ft.)
P.L.
C.B.
FIG. 6
API SIZE 228-D
Stroke – 74 Inches
Rod String – 1, ⅞, ¾-Inch
Tubing Size – 2½-Inch (No Anchor)
Fluid Gradient – .433 psi/ft.
Torque Calculated Assuming Unit 5% Out of Counterbalance
(————) As Indicated
(- - - - - - -) At 12 SPM
Counterbalance Is for Both Speeds

TABLE 3—MINIMUM COUNTERBALANCE FOR LOADING STRUCTURE AND MAXIMUM USABLE COUNTERBALANCE

API reducer size	Stroke length, in.	Rod string, in.	Beam capacity, lb.	Minimum counterbalance	Maximum usable counterbalance
57-D	42	⅝	9,200	6,480	7,400
80-D	48	¾-⅝	13,300	9,970	10,800
114-D	54	¾-⅝	13,300	9,080	10,800
160-D	64	⅞-¾	18,000	13,000	15,800
228-D	74	⅞-¾	18,000	11,840	15,800
228-D	74	1⅛-¾	23,600	17,440	18,500
320-D	84	⅞-¾	18,000	10,380	15,800
320-D	84	1⅛-¾	23,600	15,980	18,500

means the unit cannot be utilized efficiently to as great a depth as can the beam and the rod string.

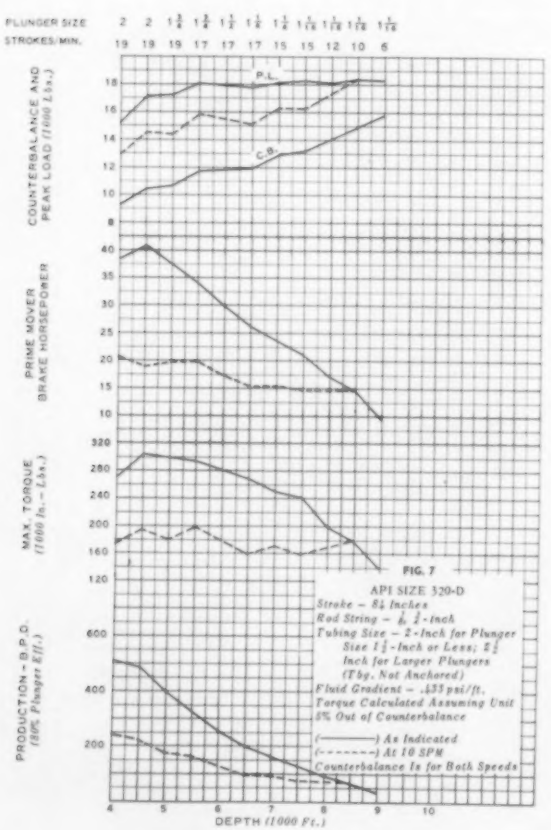
Sample calculation . . . As an example of how this information can be used to advantage, consider a rather common application of a 228-D unit on a well which is equipped with 2-in. tubing. The maximum-size rod that can be used is ⅞ in. Therefore, the maximum allowable load is 18,000 lb. based on a 30,000-psi. stress, and the minimum beam capacity that can fully utilize the rods is an 18,000-lb. beam. The minimum counterbalance effect on a 74-in.-stroke unit that will permit loading the beam and the rods without overloading the gear box is 11,830 lb., and the maximum counterbalance effect that can possibly be utilized on the unit is 15,800 lb.

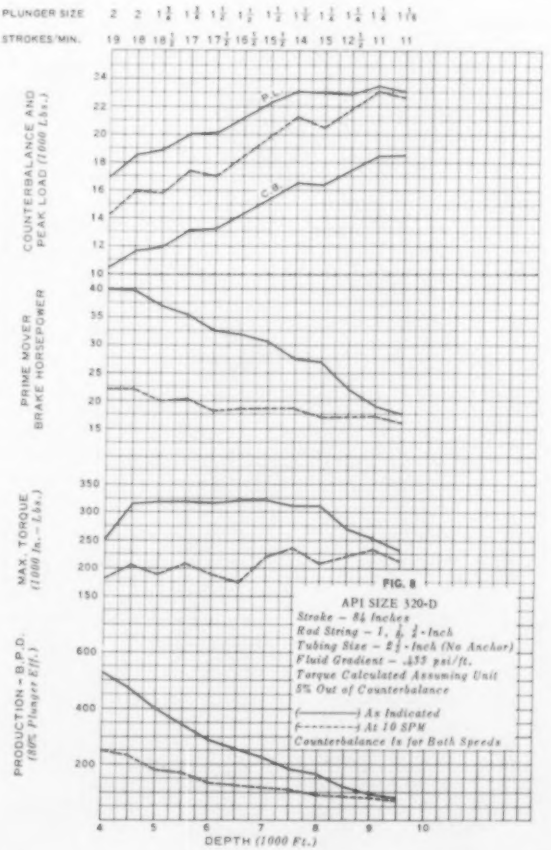
A 228-D unit installed on a deep well with 2½-in. tubing could utilize a 23,600-lb. structure and would have minimum and maximum usable counterbalance requirements of 17,440 and 18,500 lb., respectively. In other words, a light 228-D for application with 2-in. tubing and a heavy 228-D for application with 2½-in. tubing would result. If this line of thinking is acceptable, it would give the manufacturer an indication of desirable beam capacity and counterbalance requirements on various unit sizes.

Use of curves . . . Regardless of the method used in calculating pumping-unit requirements, characteristic curves of the type shown in Figs. 1 through 8 can be very helpful in the rapid selection of unit specifications. These curves were calculated to show maximum production. Therefore, plunger size and speed for a particular depth are optimum; i.e., a larger plunger will require a slower speed and will result in increased rod and tubing stretch which will more than offset the larger plunger constant. Increased speed, where possible without exceeding the free fall of the rods, results in overloading the gearbox or rod string.

These optimum combinations will vary slightly when the gradient of the fluid being lifted is other than a freshwater gradient or when the net lift is less than pump depth. However, these optimum plunger sizes and speeds shown represent good starting values for more detailed calculations. A slower speed is indicated by the dashed line to enable extrapolation of fluid volumes and unit requirements at speeds other than maximum.

Limitations of pumping unit . . . In addition to making rapid selection of unit specifications possible, Figs. 1 through 8 show that the horsepower that can be transmitted through the system is limited by gearbox torque capacity at the shallow and intermediate depths and by rod strength (peak-load curve) at the deeper depths. This

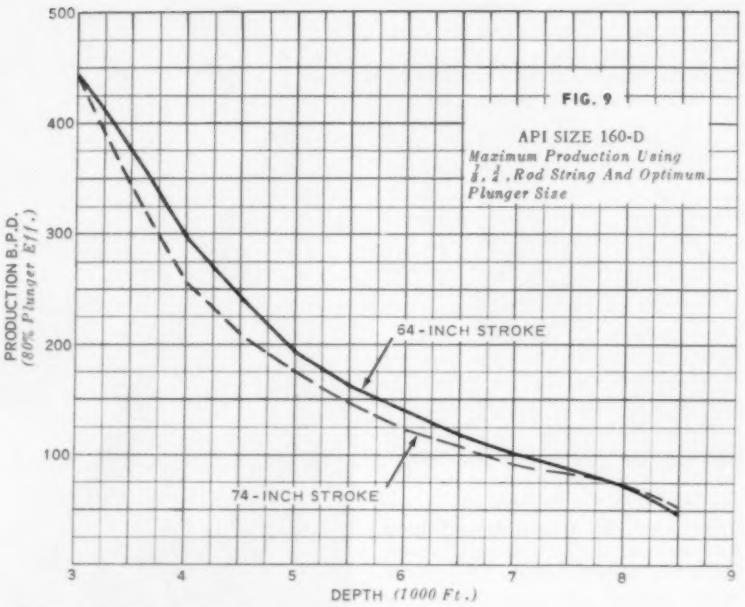

PLUNGER SIZE
STROKES/MIN.
COUNTERBALANCE AND PEAK LOAD (1000 Lbs.)
P.L.
C.B.
PRIME MOVER BRAKE HORSEPOWER
MAX. TORQUE (1000 In.-Lbs.)
PRODUCTION - B.P.D. (80% Plunger Eff.)
DEPTH (1000 Ft.)
FIG. 7
API SIZE 320-D
Stroke – 84 Inches
Rod String – ⅞, ¾-Inch
Tubing Size – 2-Inch for Plunger Size 1½-Inch or Less; 2½ Inch for Larger Plungers (Tbg. Not Anchored)
Fluid Gradient – .433 psi/ft.
Torque Calculated Assuming Unit 5% Out of Counterbalance
(————) As Indicated
(– – – – –) At 10 SPM
Counterbalance Is for Both Speeds


PLUNGER SIZE
STROKES/MIN.
COUNTERBALANCE AND PEAK LOAD (1000 Lbs.)
P.L.
C.B.
PRIME MOVER BRAKE HORSEPOWER
MAX. TORQUE (1000 In.-Lbs.)
PRODUCTION - B.P.D. (80% Plunger Eff.)
DEPTH (1000 Ft.)
FIG. 8
API SIZE 320-D
Stroke – 84 Inches
Rod String – 1, ⅞, ¾-Inch
Tubing Size – 2½-Inch (No Anchor)
Fluid Gradient – .433 psi/ft.
Torque Calculated Assuming Unit 5% Out of Counterbalance
(————) As Indicated
(– – – – –) At 10 SPM
Counterbalance Is for Both Speeds

is a result of the wider range of loads that occur at the shallow depths where it is possible to use large plunger sizes and fast speeds. Because speed and plunger size must be reduced at the greater depths to avoid overloading the gearbox or rods, the range of loading decreases, permitting counterbalancing of a larger per cent of the load. It can be observed that the torque falls off very rapidly after the rod stress becomes the limiting factor. Prime-mover horsepower requirement is a maximum at a relatively shallow depth and decreases significantly as the depth increases. Maximum production and maximum possible counterbalance requirement for the particular rod string, gearbox, and stroke length may also be obtained from the graphs. It is interesting to note how the maximum production curve declines with depth. The producing capacity of many wells declines in a similar manner as the bottom-hole pressure gradually depletes.

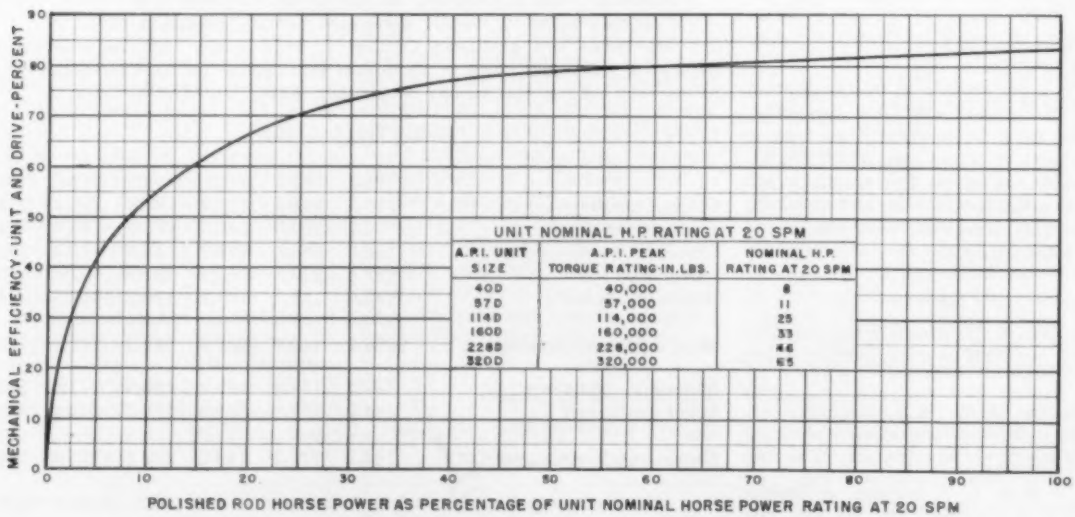
A good illustration of why the component parts of a sucker-rod pumping system should be designed consistent with the weakest link is shown in Fig. 7. This figure shows that a 320-D unit cannot be fully loaded when used with a combination ⅞ and ¾-in. rod string. Where the maximum-size tubing is 2½-in. and insert pumps are used, the gearbox capacity cannot be used. The rate at which the rods will fall causes speed to be the limiting factor to 5,500 ft; and rod stress is the limiting factor below 5,500 ft.

Optimum stroke . . . Fig. 9 illustrates that optimum stroke lengths for a given gearbox capacity can be determined by plotting a family of curves of producing rate vs. depth. It is shown here that, for depths from 3,000 ft. to 8,000 ft., more production can be obtained with a 64-in.-stroke 160-D unit than with a 74-in.-stroke 160-D unit. For shallower or deeper depths, higher volumes can be obtained with the longer stroke length. For other than maximum conditions, the same production can be obtained with fewer strokes per minute by using the longer stroke.



OPTIMUM STROKE LENGTHS for a given gearbox capacity can be determined by plotting a family of curves of producing rate versus depth. Fig. 9.

Need for standardization . . . Fig. 4 may be used to illustrate two points: (1) the use of graphical information in selecting pumping units; and (2) the benefits that could be obtained through the standardization of pumping-unit structural capacities. Assume that the volume of fluid to be lifted from a 6,500-ft. well has been established as 125 bbl. per day. The 64-in.-stroke 160-D unit shown in Fig. 4 should be adequate to meet these requirements. If the producing characteristics of this well were such that the net lift initially was 5,000 ft, the required beam capacity and counterbalance effect would be 13,200 and 10,000 lb., respectively. If the well



UNIT NOMINAL H.P RATING AT 20 SPM

A.P.I. UNIT SIZE	A.P.I. PEAK TORQUE RATING-IN.-LBS.	NOMINAL H.P. RATING AT 20 SPM
40D	40,000	8
57D	57,000	11
114D	114,000	25
160D	160,000	33
228D	228,000	46
320D	320,000	65

Fig. 10.

was still capable of producing 125 bbl. per day when the net lift was 6,500 ft., the beam capacity and counterbalance requirements would be 16,500 and 12,000 lb, respectively. On the basis of this analysis, it follows that the minimum unit specifications would be a 16,500-lb. beam capacity unit with 10,000 lb. of counterbalance initially, and 2,000 lb. of additional counterbalance available through the adjustment of weights, the addition of auxiliary weights, or the exchange of master weights. This is the maximum requirement for this well. But it should be realized that this unit has little or no flexibility for application on future deeper wells.

The required beam capacity determined in the foregoing example may be fine for one manufacturer but may not be a standard size offered by another. Thus, the second manufacturer may have to design and build a new beam and structure with the approximate required structural capacity in order to be competitive. Although competition is necessary if business is to remain healthy, this type of competition, based on the absolute value of structural capacity, is one reason for the large number of structural capacities now offered by pumping-unit manufacturers. Because of the multitude of structural sizes now being built, manufacturers must maintain large inventories. This, in turn, causes unit costs to be high. In the case of the example well, it is possible that, through some amount of standardization on beam capacities, an 18,000-lb. beam unit could be purchased for same price that a 16,500-lb. beam unit could be purchased under today's conditions. Such standardization could make it possible to obtain a unit with maximum flexibility for future use on deeper wells for the same price as a lighter beam unit which would be limited in future applications.

As a prerequisite to standardization of beam and structural capacities, there must be a general acceptance by users of a uniform maximum allowable rod stress. This would permit standardization of bean and structural capacities consistent with the allowable rod loading.

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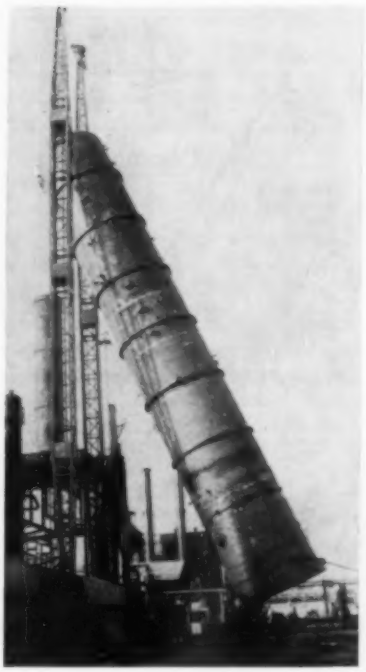
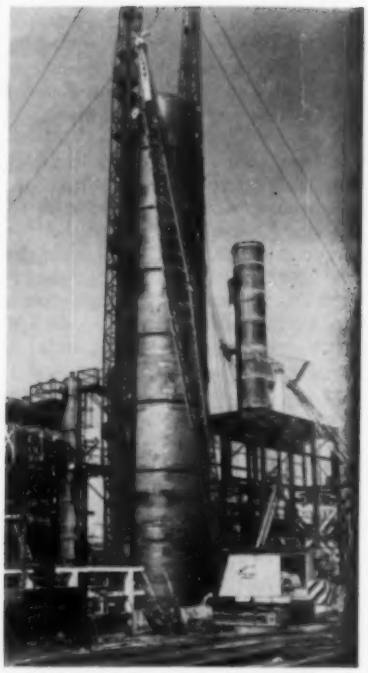


. . . up she goes

THE distillation column of a crude unit was recently raised at the Salt Lake City refining of Utah Oil Refining Co., a subsidiary of Standard Oil Co. of Indiana.

When completed this June, the unit will process 37,500 bbl. per day of crude oil into seven product streams, ranging from light naphtha to diesel oil and reduced crude. Its total cost will be over $2,000,000.

The column, which was completely shop-fabricated and erected in one piece, weighs over 140 tons with its trays. Raised and set in less than 8 hours, it stands over 100 ft. above grade. Its over-all diameter is 15 ft.



. . . happy landing

Extreme caution was used during the erection period, since the site lay between two continuously operating units. The site is also bounded by a primary road and railroad tracks, which cut down working space.

Fluor Corp. raised the column.

Nelson Refinery Construction Index

Appears in the Engineering Section in the first issue each month. Compiled by W. L. Nelson, petroleum refinery consultant, Tulsa.

The Index was explained October 1, 1956 (page 110), as well as the Indexes of Individual Items of Equipment that appear on the Costimating page in the first issue of the months of January, April, July, and October.

	Index (1946 = 100)					
	1950	1954	1955	1956	1957	Jan. 1958
Pumps, compressors, etc.	138.2	166.5	172.2	192.0	206.7	212.9
Electrical machinery	134.9	160.0	162.5	175.0	188.9	191.3
Internal-combustion engines	126.0	150.5	153.2	164.0	173.9	178.2
Instruments	127.8	154.6	162.9	182.1	187.4	193.2
Heat exchangers	140.0	171.7	156.8	190.7	203.6	193.5
Misc. equipment average	*126.2	160.7	161.5	180.5	192.1	193.8
Materials component	149.5	174.6	176.1	190.4	201.9	203.3
Labor component	144.0	183.3	189.6	198.2	208.6	215.5
Nelson construction index	146.2	179.8	184.2	195.3	205.9	210.6

*Used in computing the Nelson Index until April 1952. This is slightly different from the average of the Miscellaneous Equipment Items shown above.

B. C. BARNES

C. P. STANLEY

JAMES HACKNEY

A. H. CARAMEROS

These panelists helped operators discover . . .

"What's wrong with my plant?"

THIS provocative title headlined a panel session at a recent Natural Gasoline Association of America regional meeting in Odessa, Tex.

Panelists chewed over questions submitted from the floor and came up with some operating tips for their fellow operators. For instance, panel members suggested:

1. The use of light molecular-weight oil in the absorption system.
2. A study of piston-ring arrangements to come up with the best combination for optimum engine performance.
3. A trend is developing toward the low-temperature plant as a means of reducing fuel costs.
4. A good place to eliminate corrosion and dehydration problems is back on the lease, rather than at the plant.

Panel members at the session were A. H. Carameros, El Paso Natural Gas Co., El Paso; James Hackney, Humble Oil & Refining Co., Midland, Tex.; C. P. Stanley, Dresser Engineering Co., Tulsa; and B. C. Barnes, Magnolia Petroleum Co., Dallas.

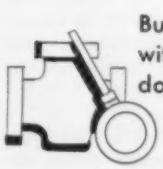
The panelists kicked off the session by summarizing various phases of plant operations. Their comments were then supplemented as they answered questions on these phases. The composite discussion of their comments and answers follows:

Compressors . . . Most maintenance problems in gas-compressor installations occur in the prime movers (with the exception of electric motors) Carameros said, with the two-cycle and four-cycle engines comparing favorably with respect to maintenance.

Ignition timing of an engine is a source of constant, though minor trouble. In the two-cycle engine slight misadjustments are critical and will mean the difference between operation and complete shutdown. You can run the four-cycle engine even though its considerably off in timing. However, this will eventually lead to greater maintenance on more expensive parts.

Most maintenance timing of the engine is to make proper adjustments periodically. Power for firing the engine will come from either a magneto or interrupter. The two systems are comparable, except power loss will shut down engines with interrupters while magneto-fired engines will continue to operate, Carameros noted.

Intake and exhaust valves on four-cycle engines and fuel-injection valves on two-cycle engines should be checked periodically for burning and wear. If either of these is not excessive, the condition can be remedied by grinding. Reasonable success has been encountered in building up the valves by welding on stellite and then regrinding. Done in quantity, this technique can reduce maintenance costs considerably. The stellite valves will last two to three times longer than the original.



Build up worn valves with stellite and grind down to size

Crankshafts . . . Properly designed crankshafts should last indefinitely. Some shafts have broken due to misalignment and during initial operation oil holes were found to have their corners too sharp and gave rise to high stresses which eventually broke the shaft. This trouble was partly eliminated by radiusing the corner of the oil holes, although a torsion analysis indicated counterweights should be changed. A dye check for cracks in the shaft should be run whenever possible. If any small cracks are found, they should be ground out or stopped by drilling at the end of the crack.

Get rid of small cracks in crankshafts either by grinding or drilling hole at each end

Life of the piston, liner, and rings are closely related and their trouble-free operation depends on several factors, said Carameros. Here is where the maintenance man can really show his abilities in proper engine mainte-

nance. Many manfacturers come out with a recommended ring arrangement for use with their equipment. However, their recommendations do not always give optimum performance.

For instance after several years of operation, El Paso found on one make of engine that the best combination

Increase piston life by proper selection and arrangement of rings

called for a flat square-cut power ring, three tapered-face compression rings, and two scraper conformable-type oil-control rings with oil holes drilled in both grooves of the piston.

In any case, oil consumption, carbon buildup, and power loss are the best indications of improper ring arrangements. If a proper ring arrangement is used, maintenance on cylinder and pistons is negligible. Oil-cooled pistons have possibilities. Some of these were installed in four-cycle engines which repeatedly had stuck pistons. These have not stuck since changing to the oil-cooled design.

Water treating . . . Major problems in water treating for reciprocating engines consist of preventing the formation of scale, elimination of corrosion, and minimizing sediment. One relatively inexpensive way to provide non-scaling water is to treat it in a sodium cation-exchanger type of softener. Once calcium and magnesium have been removed, water containing a relatively high amount of other dissolved minerals will not form an undesirable scale.

Use chromate compound with organics in treating corrosive cooling water

The chromate treatment is particularly effective in eliminating corrosion. This treats the cause rather than the symptom, and a small residual amount of chromate will cause an otherwise corrosive water to become noncorrosive while also depositing a protective film. A chromate compound prepared by a reliable water-treating company is more desirable than the use of straight sodium or potassium chromate or bichromate. The prepared chromate compound—which contains an organic—is far more effective and easier to handle.

Valve problems . . . In modern compressors, the use of high-clearance, low-velocity, low-pressure valves are in common use. The three most popular designs are the feather, double-deck, and poppet. Problems on the first two are somewhat similar. Breakage of the valve plates is a common problem in double-deck valves. After many field tests, proper values of valve thickness and clearance can be determined. Poppet valves have been noted for long trouble free operation.

Packing on piston rods occasionally wears out but also gives long hours of good operation. Some gasket erosion on soft bronze gaskets has been experienced but was probably due to sulfur content of the gas. Stainless-steel gaskets have been tried, but are hard to seal off. Soft rope packing on the unloader rods has been changed to an O-ring bakelite design and has given good service.

Lubrication with compressors has never been the problem as with the engines. Generally on main-line service most operators are likely to over-lubricate since a considerable amount of oil is in the gas anyway. In field gathering lines the liquids tend to cut the lubricant and give more trouble. Oil consumption on both two and four-cycle engines should run about

Use lightweight oil to control viscosity of lube oil

8,000 to 10,000 b.hp.-hr. per gallon consumed.

The question of using earth filters for detergent lube oils has never been completely settled. Earth filters are one of the best, being economical and adequate. The earth does tend to remove detergent from the oil. Reports have been made, however, that the detergent will be removed by the filter up to the time the engine starts making acid. Then, on a preferential basis it will start taking out acid and returning detergent to the oil. In lubrication, the main role is to maintain the proper oil film. If all factors are equal, it is practical to control the viscosity of the lubricating oil by adding a lighter-weight oil as makeup. The most important factor in changing oil is the neutralization number of the oil which is determined by lube-oil analysis.

Refrigeration plants . . . Two types of refrigeration gasoline plants are

Refrigeration-absorption plants on the upswing

currently being designed and built, Stanley stated. The most common is straight refrigeration type for condensation of gasoline and liquefied petroleum gas. This type is applicable for reasonably high recoveries from rich gas and is often the most economical plant for small volumes of gas.

The straight refrigeration process is also used for conditioning lean well gas for pipeline delivery by removing the heavy hydrocarbons which would otherwise drop out in the gas pipeline and interfere with pipeline efficiency.

One such plant has been in operation by Northern Natural Gas Co., in the Hugoton lean-gas field for several years. This plant processes 185 M.M.c.f.d. but recovers only 20,000 gal. per day of 20-lb. gasoline since this is all that drops out at a temperature of 25° F. and 750 lb. Propane and lighter products condensed are compressed and returned to the gas line as the 20-lb. product is stabilized.

Absorption plant . . . Another type recently gaining prominence is the absorption plant operating in the vicinity of 0° F. and using 140-150 mol.-wt. oil. This is a very good process for high butane and propane recoveries from medium to moderately lean gas.

One plant using this is the Red Fish Bay plant near Corpus Christi owned by Sunray Mid-Continent Oil Co. and associated companies (OGJ, April 16, 1956, p. 244). This plant economically recovers 80% of the propane and substantially all butanes plus from 140 M.M.c.f.d. high-pressure gas containing only slightly over 1 gal. per M.c.f. of propane and heavier.

The total lean-oil circulation to absorbers and rich-oil stabilizer for processing this 140 M.M.c.f. is 668 g.p.m. at —10° F. If this recovery were obtained at 90° F. absorber temperature, four times this oil circulation would be required and the resulting C_1 and C_2 absorbed along with the C_3 would require three times the recompressor horsepower now required for returning to the gas line.

The total engine horsepower for the refrigeration plant including compressors, lean oil, and recompression is approximately the same. In fact it is

2% less than would be required for lean oil and recompression alone for the same recovery at 90° F.

The 140-mol.-wt. oil has a normal boiling point at 325° F. and is stripped by straight heat requiring no steam or other stripping medium. Since oil circulation is only one-fourth that in a normal temperature plant, very good heat recovery is obtained, a much smaller furnace is required, and consequently much less fuel is used. The fuel-gas requirement for this plant is only 1.3% of gas processed, or only two-thirds the fuel required for a comparable conventional plant, Stanley stated.

Gas prices up . . . With the increase in value of residue gas, new emphasis is being placed on efficiency and economy of operation as well as first cost of plants. An absorption plant of this type operating at low temperature obtained by a propane compressor refrigeration system will often be cheaper to build and will invariably operate with less fuel than a conventional plant.

In fact Stanley said he was sold on this process to the extent he didn't feel many more large gasoline plants would be built for normal atmospheric temperature absorption.

The best refrigeration system to use with a choice of propane and ammonia would be the ammonia plant. It requires less horsepower per ton of refrigeration and is usually more efficient. Generally speaking, these are only practical where ammonia is readily available. Meanwhile, propane is always available at a gasoline plant, and hence it will probably be the system most used.

Plant operations . . . An important factor in plant operations is the declining oil allowable and the subsequent reduction in casing-head gas, Hackney noted. This tends to increase unit operating costs, which in the long run have to be reduced for profitable operations. The product prices are generally staying pretty well fixed, and the operator meanwhile is faced with higher labor and material costs. Hence, more efficient operations become mandatory. This includes means of reducing plant fuel requirements for as residue gas becomes more valuable net fuel consumption becomes more costly.

Preventive maintenance is one means of saving money. The major objective here is to improve onstream performance by reducing the frequency of breakdowns. A program along this line entails inspection of equipment at regular intervals, a planned servicing schedule, clean

Preventive maintenance will save money

equipment, and good records to aid in future overhauls.

Fuel requirements in a plant can be held down by proper regulation of combustible mixtures to fired heaters and engines. It can also be reduced by shutting down units not required rather than operating several at part capacity. Excess consumption of steam and other plant utilities should be avoided.

For instance, if a 98% purity product is being produced where specifications only call for a 95% purity, the operator can cut back operations to come closer to the specifications. In this way he can reduce power and heat consumption and still operate within contractural obligations. An increased use of high-B.t.u. gas for fuel purposes can be made with the low-B.t.u. gas being diverted exclusively to residue systems.

Lighter oil . . . A lighter absorption oil can save money. The product extracted is related to the moles circu-

Light-mol.-wt. absorption oil can make you money

lated in a system. The light oil has more moles per gallon and hence more liquids can be absorbed per gallon of this oil. Or, the same amount of gas can be absorbed by a smaller amount of oil circulated, thereby reducing power costs. In one installation, propane production was increased by 10,000 gal. per day using lightweight oil. The value of this was about five times greater than that of the light oil lost by vaporization, Hackney stated.

A good safety record can't be overlooked, he noted. In general, a safe plant is one with clean, well-maintained equipment which results in more efficient operation.

Problems . . . Many plant operating problems are caused by the presence of water, air, and acid gases in the inlet gas streams, Barnes noted. The operator usually overcomes these by removing the materials causing the operating difficulties or by establishing operating control procedures which allow him to live with his problems.

An alternate solution to these plant problems would be to remove water and corrosive compounds from gas feed streams before they enter the plant. Current practice calls for installation and operation of production, gathering, and compression facilities to prevent the entry of air into the gas stream. Gas dehydration or treating units may be installed to remove water and acid gases on the producing leases.

Partial removal of these materials at the lease may be accomplished by operating primary separators at a high pressure and low temperature. Low separation temperatures may be obtained by direct expansion when a high-pressure-gas source is available. Or, cooling may be obtained by heat exchange with cool gas, air, or a refrigerant material.

Rigid requirements . . . The cold separation plant must be carefully engineered and controlled to operate safely and with nominal labor requirements. Temperature controllers, liquid phase heaters, or the injection of antifreeze agents may be employed to maintain operable conditions. Installation of these additional lease facilities increase the lease investment and may complicate the pumper's job.

Content of the primary separator gas will be reduced, and the volume of secondary separator flash vapors will be increased. On the other hand the volume of liquids recoverable by lease separation may be increased. Freezeups, corrosion, and pressure surges due to liquid accumulations in gas-gathering lines and in the plant ahead of treating units may be re-

Lease installations can eliminate plant problems

duced. The loading on dehydration and treating units in the plant may be reduced, and there may be an over-all saving in fuel requirements for gas production and handling.

Technical data, operating technique, and newly designed field production units provide the tools to accomplish partial or complete dehydration and treating at the producing lease. The most economical solution to some of the plant treating and dehydration problems may be found by looking outside the plant fence, Barnes concluded.

ELEMENTS OF FIELD PROCESSING—51

Enthalpy changes—using graphs and nomographs

DR. JOHN M. CAMPBELL
University of Oklahoma

THE NOMOGRAPH shown in Part 50 is primarily applicable to gases and light-hydrocarbon liquids. A slightly different correlation is shown in Fig. 1 which is applicable for heavier as well as light liquids. No pressure correction is necessary for the enthalpy of liquid is relatively insensitive to pressure.

The properties of liquid mixtures are commonly expressed by a characterization factor (K) which is equal to

$$\frac{(\text{Cubic avg. boiling pt., °R.})^{1/3}}{\text{Sp. gr. of liquid}}$$

This factor is commonly used in refining but seldom with crude mixtures. For most lease applications K = 11.8 and this value has been used in preparing Fig. 1.

Watson and Nelson[10] have proposed an equation for C_p which agrees well with Fig. 1.

$$C_p = 0.68 - 0.31S + T \times (0.00082 - 0.00031S)$$

where:

T = average temperature, °F.

S = specific gravity (water = 1.0)

Either this equation or Fig. 1 will yield specific heat values suitable for most lease calculations.

Example: Determine the amount of heat that must be transferred to 40° API to heat 20 bbl. per hour from 80° to 160° F. in a treater.

Solution: From Part 46,

$$\text{Lb./hr. oil} = (350)(20)\frac{141.5}{131.5 + 40} = \mathbf{5{,}780}$$

From Fig. 1,

H_1 = 35 B.t.u./lb.,

H_2 = **75 B.t.u./lb.**

$\therefore \Delta H = (5{,}780)(75)$

= **434,000 B.t.u./hr.**

Phase Changes

Estimation of the enthalpy changes associated with phase changes is essential in lease processing. Vaporization takes place during heating and treating operations while condensation is prevalent during cooling. The ability to estimate this enthalpy then enables one to determine the work and/or heat transfer necessary to accomplish these changes.

Heat of vaporization . . . When the change of phase takes place at constant pressure (isobaric) and constant temperature (isothermal), the resultant enthalpy change is normally known as the heat of vaporization. The magnitude of this change may be found by:

1. Subtracting the liquid enthalpy from that of the vapor at existing conditions.
2. General correlation of heats of vaporization.
3. Use of partial enthalpies for the pure components making up the mixture.

The first procedure makes use of the data in Parts 49-51, or its equivalent. General correlations (Method 2) have been proposed that are in general agreement with values published for pure hydrocarbons.[2] The Clapeyran Equation (Part 48) is suitable for pure components[4,5,6] but is not applicable directly to mixtures. However, a similar equation proposed by Kistiakowsky has given generally good agreement with experimental values at atmospheric pressure.[1]

$$\Delta H_L = T/M\,(7.58 + 4.57 \log T) \quad (1)$$

where

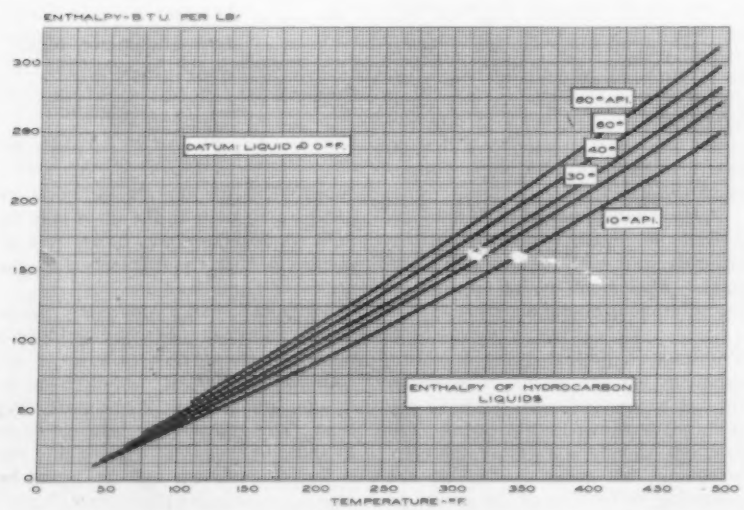
ΔH_L = latent heat of vaporization at 1 atm.-B.t.u./lb.
T = avg. boiling pt., °R.
M = mol. wt., lb./lb.-mol.

Fig. 2 is equivalent to Equation 1. Fig. 3 is suitable for estimating the average boiling point of liquid mixtures from the API gravity.

The latent heat of vaporization is a function of pressure inasmuch as the vapor enthalpy varies correspondingly. The enthalpy change decreases with increasing pressure. Therefore, when vaporization occurs at high pressure, use of both vapor and liquid enthalpies is often most convenient. However, when only rough estimations are needed, the values shown in Fig. 2 may be corrected by subtracting the values shown in Fig. 4.

The partial enthalpy of a pure substance represents the contribution of a unit weight of that component to the total enthalpy of the mixture. The total enthalpy may then be found from the equation

$$H = H_1 n_1 + H_2 n_2 + H_3 n_3 + \ldots H_k n_k \quad (2)$$



ENTHALPY OF LIQUIDS is relatively insensitive to pressure. Fig. 1.

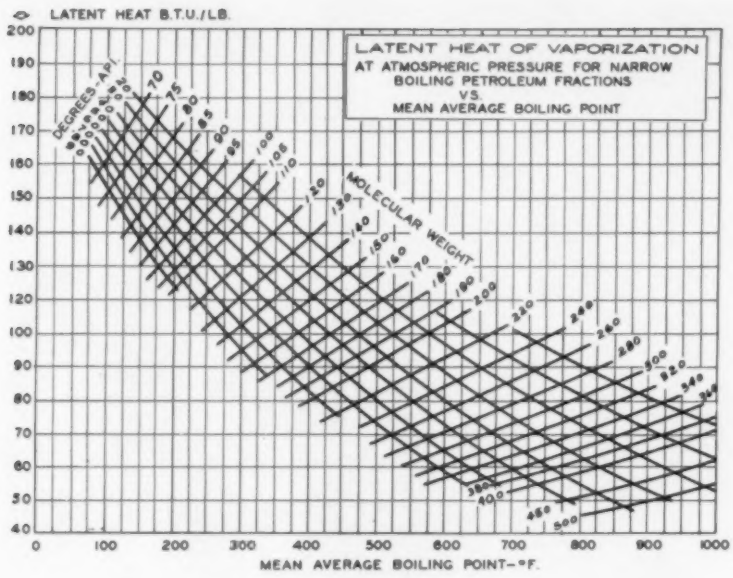


Fig. 2.

where:

H = total enthalpy, B.t.u./unit weight.

H_1, H_2, H_3, H_k = partial enthalpy of any one component.

n_1, n_2, n_3, n_k, = weight quantity of of any component, expressed as a fraction.

H is expressed in B.t.u. per lb. or B.t.u. per lb.-mole, depending on the method of correlating values. Of course, n must be in corresponding units.

The use of partial enthalpies is more complex for determination of vapor and liquid enthalpies, and heats of vaporization, but their use is necessary for accuracy where the pressure exceeds 1,000 psig. Values of partial enthalpy demand somewhat on system composition but existing correlations are generally satisfactory.[7 8]

Other Vaporization Processes

Many vaporization processes occur in which the heat of vaporization is not strictly applicable. These include those where energy other than that necessary for simple vaporization is involved or where the phase change does not occur under isobaric and isothermal conditions. An example of the former is the vaporization of water adsorbed on the surface of a desiccant. In this instance energy must be supplied to overcome surface forces as well as to cause vaporization.

An example of the second is found in vaporization through a heater or treater or absorption of a gaseous component in a processing tower. The value used to express this change is often loosely known as the heat of solution. Laboratory measurements of such changes are difficult and data to date show that a rather large uncertainty exists when trying to handle such changes, particularly where solution of the lighter hydrocarbons is involved.

Consequently, most calculators use the heat of vaporization plus a "safety factor" to account for the uncertainty. Experience has shown that this safety factor need not exceed 25%. Actually a safety factor of this magnitude is usually needed anyway to account for the uncertainties in predicting process conditions.

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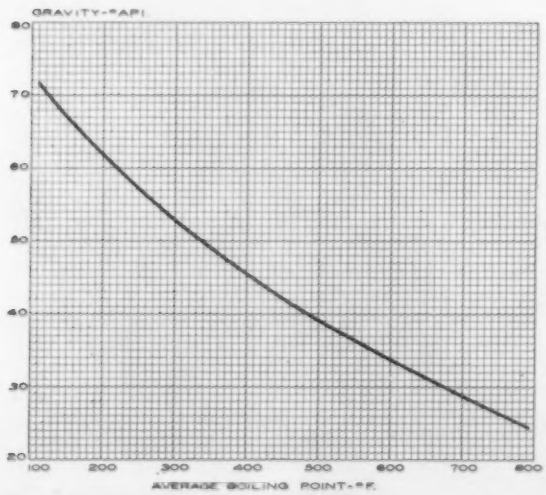
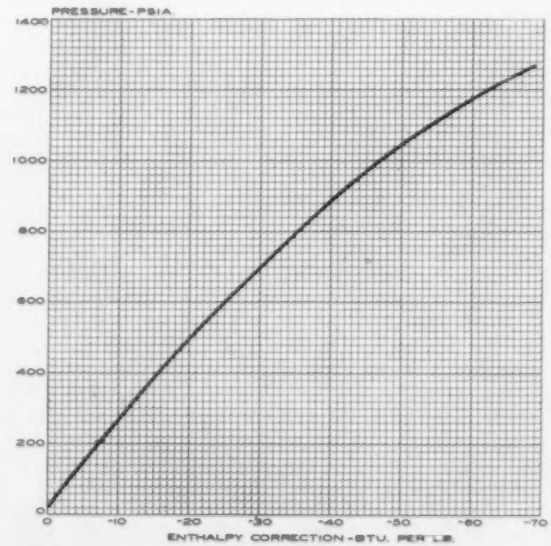


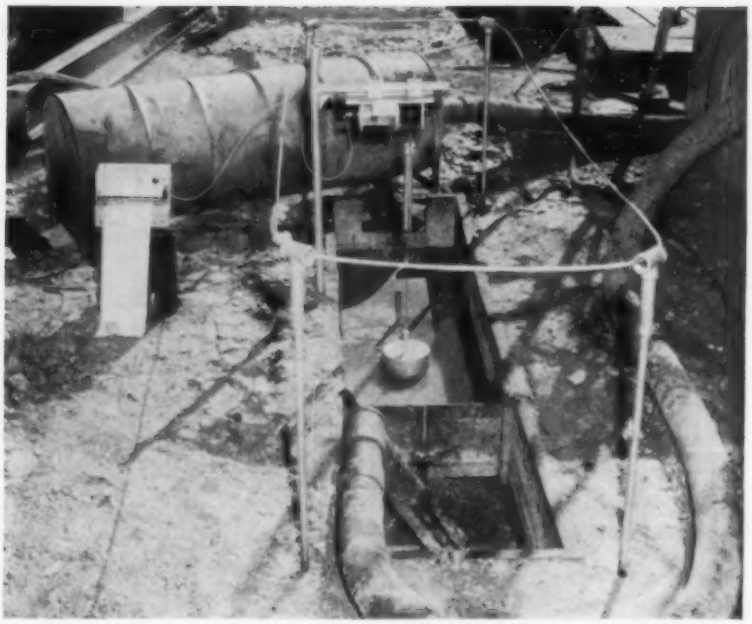
AVERAGE BOILING POINT of liquid mixtures may be estimated from the API gravity. Fig. 3.



LATENT HEAT OF VAPORIZATION varies with pressure. This chart gives approximate correlation. Fig. 4.

When Halliburton engineers needed an inexpensive way for water-flow measure while air drilling, they invented this simple, low-cost

Flow-rate device



WATER FLOW from the well is from back of the trough forward through the weir in foreground.

DRILLING ENGINEERS with Halliburton Oil Well Cementing Co., Duncan, Okla., have come up with an inexpensive way to determine the depth of water zones encountered while drilling with air.

The engineers have been drilling with air in the company's experimental well, and have coped in different ways with water-flow-measure problems, seeking a device which can inexpensively do the job.

The equipment needed to perform "on the rig," and indicate or measure the water-zone depth at the time the zone is drilled. A hindsight method, such as electric logging or some form of sample examination, would not suffice since some remedial action might be necessary as soon as the zone is encountered.

Of the several different approaches tried, the water-flow-rate method was settled upon because of its low cost and simplicity.

Here's how it works . . . Water produced from the well is flowed over a "sutro proportional weir" which passes 5 g.p.m. for every inch of water head. The water-flow rate is measured by a float adjacent to the weir (counterweighted on a ladder chain suspended from a wheel sprocket). The sprocket is mounted on a horizontal shaft leading into a 5K ohm. variable linear potentiometer wired to a strip-chart recorder.

As the water volume in the weir goes up or down, the float transmits this information via the potentiometer to the recorder.

Water zone . . . The distance between the zone's top and bottom may be calculated from the drilling record when a conventional strip-chart recorder is used. The top of the zone will be indicated when water begins spraying out of the discharge system. As the drilling goes deeper, the strip chart should increase until a constant reading (neglecting surges) is obtained, indicating the bottom of the zone.

To measure this depth, the total length of the drill pipe is added to the footage on the kelly. If drilling continues deeper and another water zone is encountered, the top of the second zone will be indicated by an increase in the amount of water produced. When the bottom is reached, the strip chart should show a stabilized flow.

The water-flow-rate logs compiled by Halliburton engineers using this method show it's possible to detect flow increases as small as ½ g.p.m. This recording sensitivity has helped drillers find the top of a water zone when the well was already producing water.

THIS FLOAT, counterweighted on a ladder chain, measures water-flow rate by recording water in weir.

The dependability of this low-cost tool can save you thousands of dollars!

BJ Red Top Centralizer

*the spring is the thing**

Reliable centering of the casing can spell the difference between success and failure of your cementing job. Protect your investment with BJ Red Top Centralizers. They have the extra centering force to assure you a smooth, even sheath of cement all the way down. Their unique design is your assurance against spring failure.

- **PRE-STRESSED SPRINGS.** Resiliency increased by stressing springs as centralizers are assembled.
- **NO WELDS TO FAIL — NO RIVETS TO POP.** Springs held in end cages by their own stress.
- **EASY INSERTION INTO HOLE.** Pre-stressing allows slim overall design with no loss of centering power.
- **NO LOAD ON CASING.** Springs fulcrum on cage. Casing always rotates freely.

* At right you can see how pre-stressing works. Compare the curvature of the unattached spring with that of the dotted-lined area it will occupy. This built-in stress gives you greater resiliency.

Special savings for export users

The BJ Red Top is the only centralizer in America that can be shipped knocked down to give you big savings on shipping costs. Special tool allows assembly at destination.

The smallest part of your cementing expense can be the most important!

BJ Red Top Scratchers

- DOUBLE SPRING CONSTRUCTION on each finger. Ten straight wires held by a tight coiled spring.
- EXCLUSIVE COIL-FLEX FINGERS always spring back into scratching position.
- MULTIPLE-WIRE FINGERTIPS fan out to increase the scratching area.
- 15° BEND IN EACH FINGER keeps mud cake undisturbed on scratcher's descent.

A BJ Red Top Scratcher amounts to only about 1/500 the cost of an average cementing job, yet it can make the big difference between whether or not your cement bonds properly to a crucial section of well bore. It's a small price for the big protection it gives your cementing investment... and BJ's patented design gives you the utmost for your scratching dollar.

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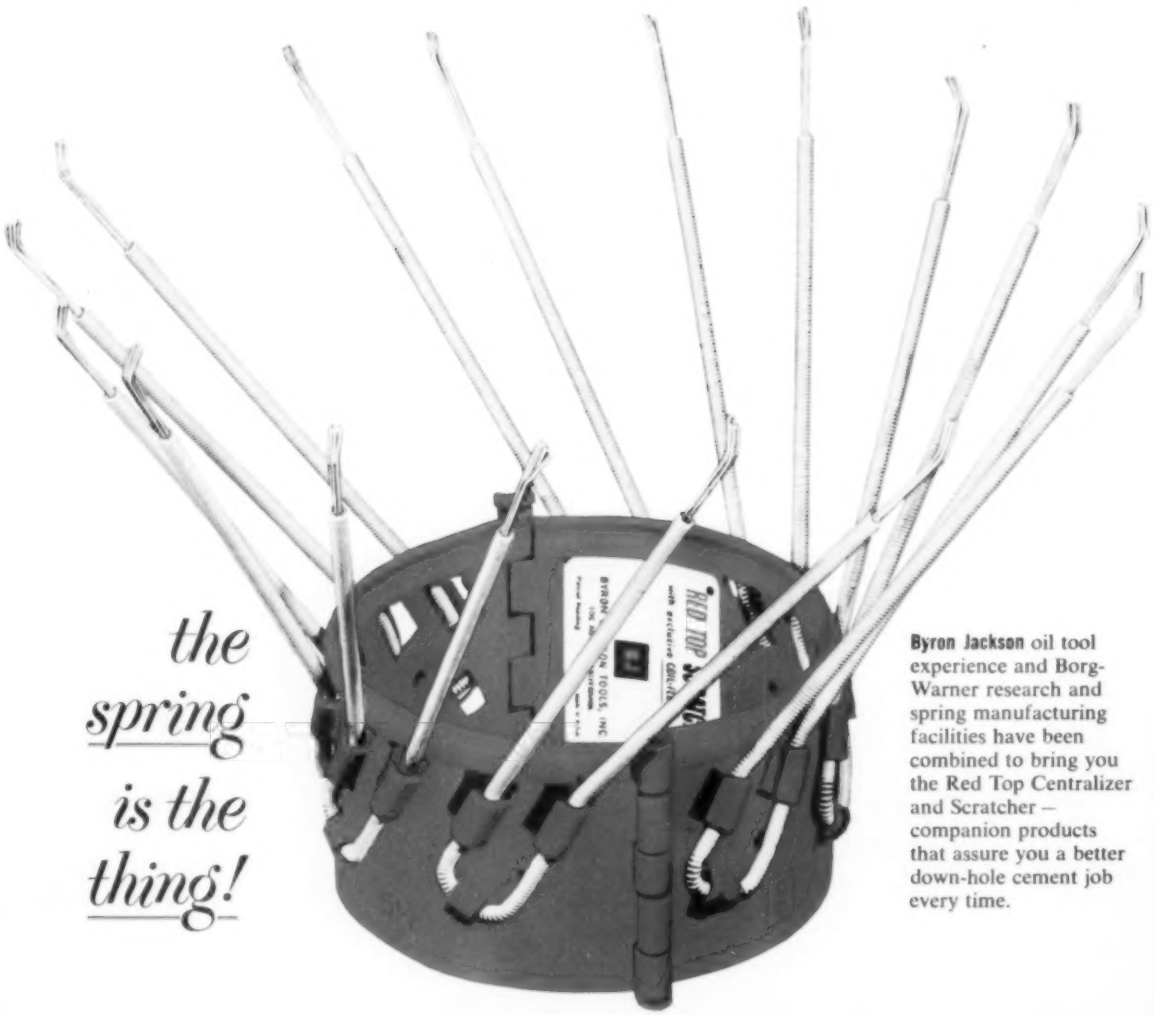
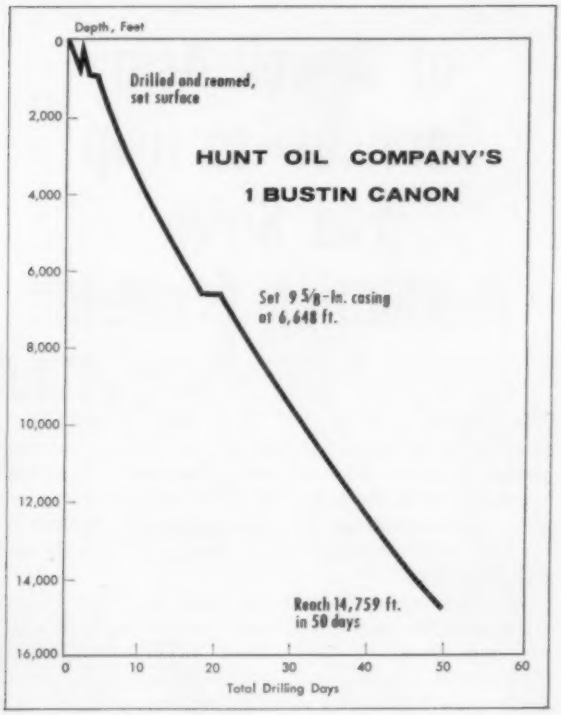


the spring is the thing!

Byron Jackson oil tool experience and Borg-Warner research and spring manufacturing facilities have been combined to bring you the Red Top Centralizer and Scratcher — companion products that assure you a better down-hole cement job every time.



PILE OF DUST in foreground is collection of cuttings from drilling with air. Well was drilled with air all the way from surface down to depth of 14,759 ft., thus setting . . .

A new record for air drilling

BY ED McGHEE
District Editor

THE DEEPEST HOLE ever drilled with air is Hunt Oil Co.'s 1 Bustin Canon in Terrell County, Texas. In January of this year that well reached a depth of 14,759 ft. And all but 900 ft. of hole was drilled with air as circulating fluid. Mud was used from 5,700 to 6,648 ft. but Hunt's 1 Bustin Canon proved that there is no mechanical limit for the depth to which air drilling may be taken.

Terrell County is hard-rock country. Yet, by air drilling, Hunt took only 86 days to reach 14,759 ft. and used only 50 bits in getting there.

Helmerich & Payne's rig 48 is on the record hole at time of this writing. The 1 Bustin Canon is 6 miles from Magnolia Petroleum Co.'s and Western Natural Gas Co.'s 1 Brown Bassett which found excellent production in both Silurian and Ellenburger formations.

From surface with air . . . Hunt set 40 ft. of 20-in. conductor pipe using air and then drilled out with a 12¼-in. bit and with air as the circulating fluid. The 12½-in. hole was taken to 950 ft. and then reamed to 17½ in. Six 500-cu.-ft. per minute supplied air for circulation at a pressure up to 190 psi. Up to 18 drill collars of 8-in. diameter were run and bit weights of 70,000 to 80,000 lb. and there was no problem with crooked hole.

At 950 ft., a string of 13⅜-in. surface pipe was run and cemented. From this point, a 12¼-in. hole was drilled to 6,648 ft. As before, air was the circulating fluid and eighteen 8-in. collars were run.

Water-bearing formations were encountered at 1,720 to 1,820 ft. These water-bearing formations gave up approximately 10 bbl. of fluid per hour. In order to continue the use of air in drilling, Hunt used the "mist" drilling technique. This technique incorporates mixing lime water and foaming agents with the air being pumped into the hole. By going to this procedure, air-drilling characteristics were maintained; fast penetration, better bit life, no balling of the bit, or plastering of the hole. The water pumped into the drill string, plus the formation water, is blown back to the surface. From 950 to 5,700 ft. it required nine 12¼-in. bits and 14 days' rig time. On an offset well drilled with fluid this section required 41 bits and 35 days' rig time.

At 5,700 ft. another water-bearing formation was penetrated. This section gave up too much fluid to continue the mist drilling. From 5,700 to 6,648 ft. the hole was drilled with mud using 9 bits and 11 days' rig time.

At 6,648 ft., a string of 9⅝-in. casing was run and cemented.

Below immediate pipe . . . Very good

Up-To-Date Checklist of Dowell Acid Services–to Help You Solve Production Problems

Dowell acidized the first oil well, using inhibited hydrochloric acid, in 1932. Since then, Dowell engineers have encountered thousands of well stimulation problems where acid—properly modified and applied—proved to be the best method of increasing production. This experience has led to the development of a wide variety of improved acids, techniques and addition agents.

For example, Dowell has developed two acids with retarded action for wells producing from fast-reacting limestone pays. These acids are especially effective in vugular and oolitic formations; and in formations containing natural fractures, or exhibiting inter-crystalline porosity.

Where the producing formation is a dense slow-acting dolomite, wells often respond better to treatment if a Dowell intensifying agent is added to the acid.

Emulsions and silicate swelling need no longer restrict production following an acid job. Dowell has developed addition agents to combat and overcome these problems.

There is no need to rule out acid treatments if your well is producing from a sandstone. Many sands show good solubility in Mud Acid.

The search for improved chemicals and new acidizing techniques continues today at Dowell. Recently, Dowell worked with operators in the Mid-Continent and Permian Basin areas to perfect the use of magnesium pellets to heat acid, as the acid is pumped into producing formations. By creating heat in this manner, Dowell has been able to remove scale and deposits unaffected by other treatments.

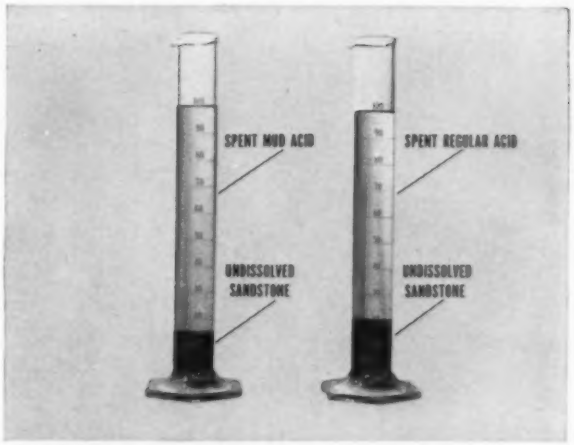
When you specify Dowell for acidizing you get the benefit of more years of experience in oil well acidizing than you can get from any other service company.

Dowell's major acid services are briefly described at the right. For service, call any of the 165 Dowell service points and offices in the United States and Canada; in Venezuela, contact United Oilwell Service. Or write Dowell Incorporated, Tulsa 1, Oklahoma.

*Trademark Dowell Incorporated.

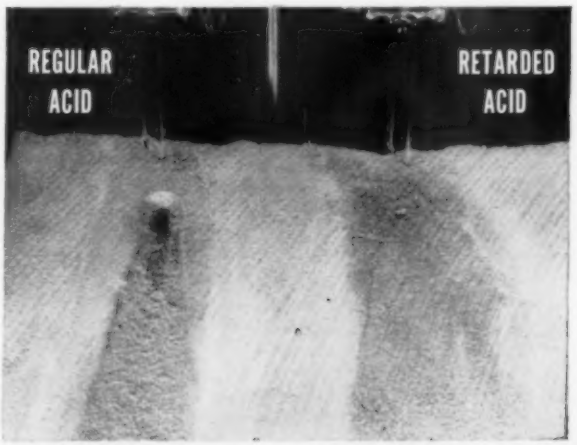
Services for the oil industry DOWELL

A SERVICE SUBSIDIARY OF THE DOW CHEMICAL COMPANY



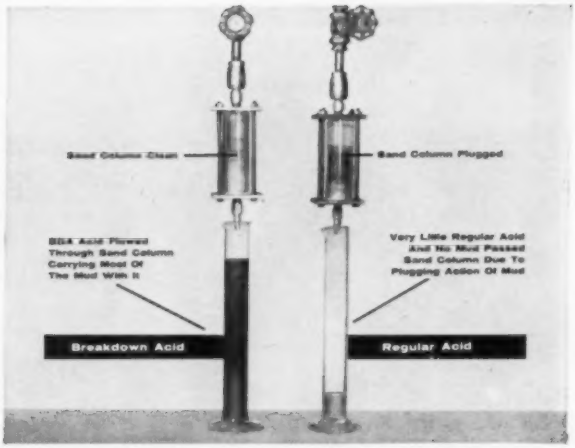
1. MUD ACID contains a special fluoride compound designed to help dissolve and disintegrate clays and bentonites. It is recommended for use in mud removal operations and for acidizing certain sandstone formations.

4. XFWM ACID contains three agents designed to reduce surface tension, reduce silicate swelling and prevent emulsions. It is commonly used as a service by itself; but is also used as a spearhead with other treatments.



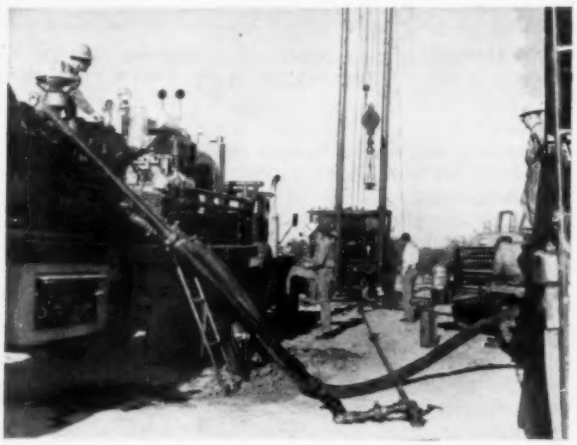
7. RETARDED ACID contains an addition agent that greatly slows down the acid action—as shown here. It is designed to create a deeper drainage area in fast-reacting limestone formations than does regular acid.

2. DOWELL REGULAR ACID is the basis for Dowell acidizing services. It is a 15 per cent by weight inhibited hydrochloric acid solution. One thousand gallons of regular Dowell acid will dissolve 10.8 cubic feet of pure limestone.


Sand Column Clean
Sand Column Plugged
BDA Acid Flowed Through Sand Column Carrying Most Of The Mud With It
Very Little Regular Acid And No Mud Passed Sand Column Due To Plugging Action Of Mud
Breakdown Acid
Regular Acid

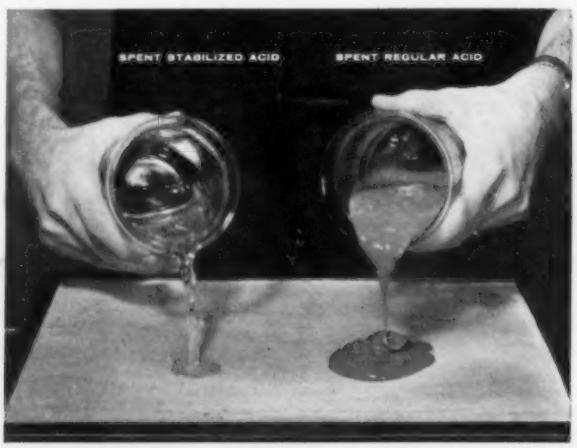
3. BREAKDOWN ACID (BDA*) contains agents that make it especially effective in breaking down and penetrating mud cake, and the formation. It is designed to be used as a spearhead for both fracturing and acidizing treatments.

5. SILICATE CONTROL ACID contains an agent designed to control the swelling of certain silicates, clays and bentonites. It is also effective in preventing or breaking oil-in-water emulsions that sometimes occur following an acid treatment.

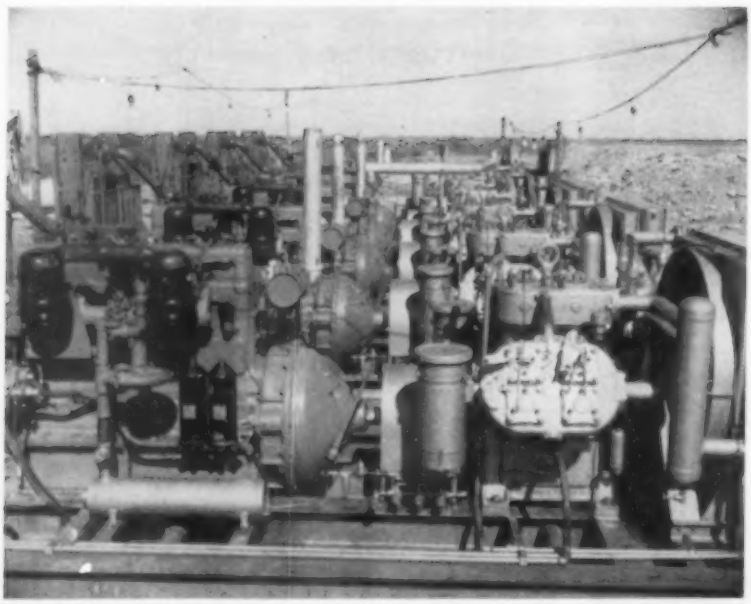


6. HEATBLAST is a new Dowell service designed to remove heavy hydrocarbons and mineral scales near the well bore by increasing the bottom hole temperature of the well. It uses a jel solution carrying magnesium pellets and a specially inhibited acid.

8. ACID PETROFRAC* is a Dowell fracturing service that uses an acid-oil emulsion as the fracturing fluid. This fluid, however, is often used on highly soluble formations—without sand—as a retarded acid.



9. STABILIZED ACID is designed to prevent the precipitation of iron hydroxide from spent acid. It is widely used to acidize waterflood input wells. It has also proved helpful in producing wells where iron salts are present.



COMPRESSORS which supplied air for drilling Hunt Oil Co.'s record breaker. There are six of these 520-cu. ft. per minute units. Maximum pressure required was 190 psi.

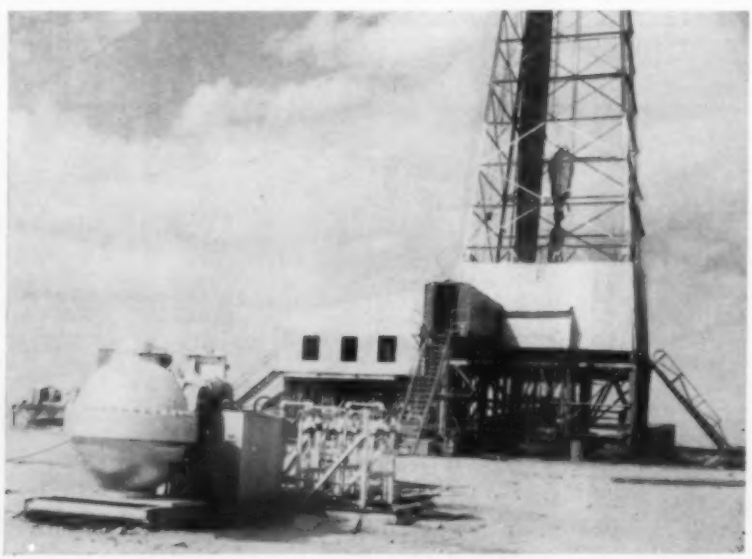
penetration rate was maintained from 6,648 to 8,350 ft. At this point in the hole—gage problem of the bit caused 2 days of reaming. From 8,350 to total depth light bit weight was run in order to keep the hole from dog-legging. Hole angle built from 3° at 8,350 ft. to 14° at 14,759 ft.

Due to hole angle at 14,000 ft., torque built up on rotating, and pipe dragged coming out of the hole for bit change. To help reduce torque, powdered graphite was injected into air stream which reduced line pull by 30,000 ft.-lb. and rotating torque by 30 to 40 ft.-lb.

When the hole reached 14,759 ft., the pipe became stuck and could not be freed. As a result, the hole was mudded up and later abandoned.

Acknowledgment

Credit is due to E. V. Barton, Hunt Oil Co., Midland, and F. W. Smith of Technical Drilling Services, Midland, for help in preparing this article.



REMOTE-CONTROL MANIFOLD on Helmerich & Payne Rig 48 which drilled the record breaker. Such remote control of blowout preventers was necessary because of the danger of entering high-pressure gas zones while drilling with air.

BOOKS

ELECTROSTATICS IN THE PETROLEUM INDUSTRY. By A. Klinkenberg and J. L. van der Minne. Published by D. Van Nostrand Co., Inc., 257 Fourth Avenue, New York 10. 191 pp. $8.

This is an account of the results of intensive research lasting several years carried out by Shell in the field of static electricity. This has been recognized for many years as a hazard in the oil industry. Time and again seemingly mysterious explosions have been traced to this source.

Shell's research has now culminated in the discovery and development of a very potent antistatic additive. Further, a better understanding has been gained of the way in which static electricity is generated and how its accumulation can be prevented.

Both laboratory research and plant-scheduled tests were conducted in much detail in arriving at these findings.

PLANT ENGINEERING PRACTICE. Published by F. W. Dodge Corp., 119 West Fortieth Street, New York 18. 704 pp. $18.50.

This is a new handbook covering every major area of plant engineering activity. The material was gathered and prepared by the editors of Plant Engineering magazine.

More than 100 experts in fields related to plant engineering wrote the material. There are 226 detailed studies organized into 13 extensive sections: Sites and Layout; Construction; Housekeeping and Safety; Materials Handling; Maintenance; Paints and Protective Coatings; Mechanical Power and Piping Systems; Electric Power; Lighting; Utilities; Heating, Ventilating and Air Conditioning; Instrumentation and Quality Control; Shopwork.

HANDBOOK OF DEGREE-DAY DATA FOR THE UNITED STATES, compiled from official records of the U. S. Weather Bureau. Published by American Petroleum Institute, 50 West Fiftieth Street, New York 20. Two volumes, $7.00 each.

Volume 1 gives extensive statistical degree-day information for 171 locations in the United States and Canada. It presents normal degree days for the entire heating season and for each month of the season.

Probabilities are shown for both warmer-than-normal and colder-than-normal weather for each location. For example, the mean-degree days from the first of December to the end of the heating season for Albany, N. Y., is 5,344. The chance is 1 in 20 that the total for that period will reach 6,069, and the chance is the same that it will drop to 4,619.

The volume also shows trend statistics for each location.

A supplementary table gives normal monthly and annual degree days for 355 stations in the United States.

Volume 2 comprises a retabulation of detailed historical degree-day data for the various stations, as recorded by the Weather Bureau. These basic data were used to calculate the statistical information in Volume 1.

Note: The Oil and Gas Journal maintains a book department. Write to the READER SERVICE DEPARTMENT, P. O. Box 1260, Tulsa 1, for copies of the book list. Often books reviewed here may be purchased from this source.

SIXTEEN-INCH Four Corners line will tap the Aneth and Bisti areas.

Automation in custody transfer and trunk-line operation, plus pressure reduction to feature *Four Corners Pipeline*

BY R. W. GUTHRIE, JR.
Shell Pipe Line Corp.

THE FOUR CORNERS pipeline, which provides an outlet to the West Coast for the crude oil discovered in the San Juan (New Mexico) and Paradox (Utah) basins, is a 50-million-dollar project connecting several of the petroleum refineries in the Los Angeles area. The 16-in. pipeline is capable of delivering 70,000 bbl. of crude oil daily to Los Angeles.

The pipeline consists of nearly 650 miles of 16-in. and 88 miles of 12-in. trunk line; 37 miles of 10, 8, 6, and 4-in. feeder lines; 3 main-line pump stations; 2 pressure-reducing stations; and 14 feeder stations.

Designed and built for Four Corners Pipe Line Co. by Shell Pipe Line Corp. as agent, the ultimate plans call for an additional 11 pump stations capable of delivering 160,000 bbl. of crude oil per day.

Automation will be effected by supervisory control and telemetering, utilizing microwave for carrying supervisory signals. The microwave and VHF system will also provide complete communication, linking the stations with the various offices and automotive equipment.

The pressure-reducing stations are designed to control the pressure at points of low elevation, using a series of pressure-dissipating tubes to reduce the pressure and prevent overstressing the pipe.

Paper presented at API spring meeting, Southwest District, Division of Production, Fort Worth, under original title, "Four Corners Pipeline."

Construction

The pipeline route was divided into nine separate sections, each contracted as a unit. From the rocky terrain in the mountains and badlands of southeastern Utah and northern Arizona, through the desert country of eastern California, to the congested Los Angeles area, the construction crews and equipment encountered every conceivable type of obstacle.

They crossed Indian reservations, blasted thousands of feet of ditch in solid rock, dredged a ditch and installed submarine crossings at the swift Colorado and San Juan rivers, and installed overhead crossings on existing bridges across the Little Colorado and Los Angeles rivers. They used mine detectors to clear a route across an abandoned U. S. Army artillery range, and built a pipeline under the city streets in Los Angeles County that could well be referred to as plumbing rather than pipelining.

Each of the three pump stations is designed so that it can be remotely operated from the pipeline terminal in Long Beach. The initial pump station (Red Mesa), located on the Navajo Indian Reservation in southeastern Utah, has three electric-motor-driven centrifugal pumps housed in a transite-clad building.

The middle pump station (Cameron), located 5 miles south of Cameron, Ariz., likewise has three electric-motor-driven centrifugal pumps, but at this station the pumps are located out-of-doors rather than in a building. The third pump station (Twentynine Palms), located 4 miles northwest of Twentynine Palms, Calif., consists of two motor-driven centrifugal pumps which, like the pumps at Cameron, are exposed to the weather. Future expansions could result in an increase to five pumps at each station.

The two pressure-reducing stations, Kingman (located near Kingman, Ariz., between Cameron and Twentynine Palms stations) and Corona (located near Corona, Calif., between Twentynine Palms station and the terminals), are described in detail.

Tankage for the storage of crude oil was held to a minimum, the only storage tanks being four 55,000-bbl. tanks at Red Mesa station. In addition to the storage tanks, relief tanks were installed as an emergency measure, one 55,000-bbl. tank at each of the two pressure-reducing stations, to be used only in the event that a failure occurs in the system as a result of equipment or power failure. Additional storage tanks will be added as required when the system is expanded.

The communications system will consist of a series of eight microwave repeater stations, which will also serve as a means of telemetering the station operating conditions to the terminal and transmitting the supervisory control signals to the pump stations and pressure-reducing stations. In addition to the eight repeater stations located at points of maximum elevation along the microwave path, microwave legs to the pump stations, pressure-reducing stations, and to the offices at Farmington, N. M., and Long Beach, Calif., are included.

Construction of the repeater stations was rather difficult because of the inaccessibility of the mountain-top locations, particularly since December when the snows and subfreezing temperature added to the transportation problems. At the repeater station located on the top of Roof Butte on the Navajo Indian Reservation in eastern

Arizona, all materials were transported the last 800 ft. by mule—no small chore when one realizes that the last 800 ft. were nearly vertical and the materials transported included sand, gravel, cement, equipment for excavating in rock, and a building.

Construction in the Los Angeles area was difficult because of the necessity of installing a considerable amount of pipe under city and county streets. In many instances the only available easements were on street rights-of-way, and even then the portion of right-of-way which was not under pavement was already congested with pipelines. Permanent street repair is being effected as soon as practicable. Easements were obtained along railroad and power line rights-of-way in several segments of the Los Angeles metropolitan area.

The pipeline was tested hydrostatically by pumping water into the system from the San Juan River in Utah. After some 235,000 bbl. of water were pumped into the system, crude-oil movements to displace the water were begun. Each section of pipeline between block valves was filled with water, and that particular section was pressure-tested. Some of the original water was wasted eventually, as the water approached the construction crews, in an effort to get as much oil as possible into the system. A few breaks have occurred in the line, due to split joints of pipe or weld breaks.

Operation

Operating the pipeline will be different in many respects from the usual pipeline operations, primarily because of the drastic elevation changes. The pipeline route begins at an elevation of 5,270 ft. above sea level in Utah and terminates at 15 ft. in Los Angeles County, with a maximum elevation of 6,690 ft. at Marsh Pass.

In addition to the usual practice of adding pressure to the oil in order to move it through the pipeline, it is also necessary to reduce the pressure at certain points of low elevation so that the pipeline pressure will not exceed a safe operating pressure and rupture the pipe.

When all the supervisory equipment has been installed, the pipeline can be operated from the terminal in Long Beach. Critical pressures and flow rates will be telemetered to the terminal operating panels; and, in most instances, the pressure can be regulated from the terminal. Supervisory equipment will enable the terminal operators to start and stop pumps, open and close valves, observe oil level in the tanks, determine the cause of failures, and control the station operation at all locations along the pipeline.

The microwave equipment may be controlled from the terminal. However, each microwave repeater and terminal station is equipped with a standby unit which will automatically switch into use in case of failure of the regular unit.

Automation is also found in the feeder system. At most leases custody of the crude oil will be transferred automatically by means of positive-displacement meters or calibrated tanks.

At the outset the initial station, Red Mesa, will be fully attended. A dormitory has been constructed which will be fully equipped to provide food and overnight lodging when required. Because of inaccessibility, extensive use will be made of aircraft throughout the Four Corners area and an airstrip has been completed at Red Mesa.

Pressure-Reducing Stations

The two pressure-reducing stations, located near Kingman, Ariz., and Corona, Calif., are included in the system to control the downstream pressure so that the pipe will not be stressed beyond its maximum operating limit at the points of low elevation. At the points of low elevation the vertical distance between the pipe elevation and the hydraulic pressure gradient, such vertical distance being measured in feet of oil, would be excessive were it not for the pressure-reducing station.

The design pressure limits of the stations are dependent upon the pipe wall thickness (upper limit) and the ground profile (lower limit). Because the range of flow rate is likely to vary considerably, it was necessary to design a system which will provide flexibility, rapid reaction to flow and pressure variations, and accuracy.

Another factor to be considered was the result which a sudden drop in the hydraulic pressure gradient would inflict on the system. If the pump station upstream from the pressure-reducing station should fail, the pressure gradient would drop and cause cavitation in the pipeline with a resultant loss of flow. Because of the length of the pipeline, considerable time would be required to reestablish normal flow rate. It is estimated that the time loss could run as much as 6 to 8 hours. It was decided to maintain relatively high upstream pressures to reduce the likelihood of cavitation.

Tests using a series of pressure-dissipating tubes, nests of small tubes or pipe within a larger pipe, resulted in a very low noise level. Further, actual pressure drop through the pressure-dissipating tubes, or friction bundles, closely approximated the calculated pressure drops. For these and other reasons, Four Corners chose to use the friction bundles.

Friction Bundles

Each friction bundle is, in this case, made of a section of 2 or 2½-in. pipe 65 ft. in length, with three sections of ¾ or 1-in. tubing welded inside the larger pipe. Pressure loss across a friction bundle is proportional to the inside surface area of the pipe, plus the inside surface area of the smaller tubes, plus the surface area of the annular space between the tubes. There are four friction bundles at each pressure-reducing station, arranged in parallel so that the entire flow of crude oil may be forced through one bundle or divided into one, two, three, or four parts.

By controlling the number of parallel friction bundles in the operation at the station, the pressure differential from suction to discharge can be regulated to a large degree. Further control of station pressure differential is effected by adjusting the position of pneumatically operated control valves which are located in series with each friction bundle. Three additional pipe sections, without the friction tubing included, are arranged in parallel with the friction bundles to increase the flexibility of the system.

Each combination of four, three, two, or one friction bundle provides a definite pressure dissipation. The control valve in series with each friction bundle gives the bundle a range of pressure loss rather than a fixed value. The four bundles and control valves are designed so that each combination will have a range which overlaps with the range of the adjacent combination.

A relief tank has been provided at each of the two pressure-reducing stations as a precaution against equipment failure. Relief valves will open and permit the oil to enter the tanks if either the upstream or downstream pressure exceeds a predetermined value. The entire station is designed with a fail-safe feature. The relief valves open on air failure and the control valves close on air failure, so that the oil stream will be diverted into the relief tank when air failure occurs.

Although operation of the pressure-reducing stations involves the use of theoretical computations, the designing engineers and operating personnel have confidence in its success. There will no doubt be revisions made in the calculated flow ranges of the various combinations of friction bundles as field tests determine actual values of pressure loss, but sufficient overlapping of ranges has been provided in anticipation of such adjustments.

Refinery Quiz:

Straight answers by experts to questions you may have faced in operating a refinery

CLEAR AND LEADED O.N. VS SEVERITY

Reforming at High Severity		
Gravity	Charge	Reformate
PONA		
ASTM		
R.O.N.w/3cc		

CLEAR AND LEADED OCTANE NUMBERS VS. SEVERITY: What is the relationship between the clear and leaded (3 cc. TEL) F-1 octane numbers with varying Platformer severity on typical East Texas stocks? For example, what are the leaded octane numbers corresponding to clear octanes in the 84 and 92 range?"

KILLEN: We can give some specific numbers that we have found on this for a full-boiling-range gasoline from a similar crude that analyzes about the same as East Texas, so far as naphthene and aromatics are concerned. I have three points here, pretty much of a straight-line correlation. We have an 84 clear leaded to 95.3 octane, 85.5 leaded to 97, and 92 leaded to 99.2 octane.

That's with a little higher than a 400° F. e.p. If you have a lower end point, a 310° F. e.p. stock leaded to 99.4 from a 92.0 clear and 270° F. e.p. cut leaded to 99.6 octane. So with the lighter stocks there is a bit of improvement in the lead susceptibility, as you'd expect. Probably some others have some similar type data that may differ a little from that.

BYRNE: Ultraforming a mixture of East Texas, South Arkansas and North Louisiana stocks, we have found the following octanes for 10-lb. gasoline. An 82 clear 10-lb. gasoline will lead to 95 at 3 cc. and 92 clear will lead to approximately 100. The relationship is linear between 82 and 92 for every increase of two clear octane there is one leaded octane increase.

WALK: In other words, your lead susceptibility does drop off with increasing severity.

JONES: I would like to ask Jay Killen a question to be certain that I understood what he said on these lower end points. Did you have reference to lower end-point reformates, or lower end-point feed stocks?

KILLEN: My reference was to lower end-point reformates.

JONES: We find, in our operation, that our octane number drops quite perceptably with decrease in end point. We run a 400 e.p. feed stock, that is, about 180° to 400° F. e.p. feed stock, to our Platformer. We produce something like 435° F. e.p. reformate (which we have to rerun for various reasons). We make 98 octane with 3 cc. of lead on the full-boiling reformate. If we rerun it to about a 325°-330° F., 90% point, and about 375° F., or so e.p., we'll lose 0.5 to 0.7 of an octane.

KILLEN: Well, that's interesting. Our data show that for the same boiling range (within the accuracy of the test method) we haven't experienced that. I don't know just why we differ there.

JONES: Well, we have some heavy

THE WPRA PANEL

MODERATOR: J. D. Walk, American Oil Co. OPERATORS' PANEL: John F. Anderson, Cooperative Refinery Association; T. J. Byrne, American Oil Co.; J. E. Eppard, D-X Sunray Oil Co.; Bruce Jones, La Gloria Oil & Gas Co.; J. M. Killen, Standard Oil Co., and Ralph L. Reynolds, Lion Oil Co. ENGINEERING PANEL: Dr. A. R. Goldsby, Stratford Engineering Corp. (now with Texaco Development Corp.); Richard R. Haig, Esso Research & Engineering Co.; C. R. McMahan, Universal Oil Products Co.; Donald E. Womeldorph, Houdry Process Corp., and B. F. Hartman, Socony Mobil Oil Co.

Part 3 of Four Parts: Cat Reforming and Desulfurization

boiling naphthenes in our feed stock which, of course, dehydrogenate to aromatics and that may be the difference. The heavy bottoms from our rerun operations will run anywhere from 104 to 106 octane number.

PLATFORMING CATALYST

R-5 R-7 R-8

PLATFORMING CATALYSTS: On East Texas and similar Mid-Continent naphthas, what particular type of Platforming catalyst appears to be the proper economic selection at the 89 and 91 clear octane level? What is magnitude of yield improvement?

McMAHAN: As most of you are aware, there are three Platforming catalysts in commercial use today: R-5, R-7 and R-8. For this particular feed, at this particular octane level, we would select R-7 in preference to R-5, and would expect a slight yield improvement for R-7 over R-5.

KILLEN: It's my understanding that if you did have a stock with quite high poisons, even at this octane level it might be beneficial to go to R-8, but Charlie is more of an authority on that.

JONES: Might I ask a question of Charlie? What about R-5S?

McMAHAN: Under certain conditions, Bruce, you might use that. Particularly in a plant that was orginally designed for R-5.

COMMENT: I would like to hear a little general discussion as to when you use R-5, when R-7, and when R-8.

McMAHAN: R-5 is the catalyst that was used in many of the early Platforming units and probably on a pound basis has been the most widely used of the Platforming catalysts. As severities increased and as we looked at poorer and poorer quality feed stocks, R-7 and R-8 catalyst were developed to meet higher severity levels, higher contamination levels in feed stocks and the poorer quality feed stocks from the standpoint of naphthenes and aromatics.

The proper selection of catalyst type depends upon feed composition and severity level desired. As a general statement, R-5 will be used for mild severity to medium severity, R-7 will be used at intermediate to high severity, high contamination and extremely poor feed stocks.

CHLORIDE CORROSION: Is anyone having corrosion problems due to chlorides in equipment where natural gasoline is being processed by catalytic reforming?

McMAHAN: At the moment, we're not aware of any true natural gasoline containing excessive chlorides. There is one instance we know of where units processing natural gasolines had high chlorides in the feed, but this was due to a contamination of tank trucks carrying chlorinated solvents which were later used to transport Platforming feed, natural gasoline in this particular case. Now, this was a transport contamination problem and not a contamination of the particular natural gasoline as produced.

EFFECT OF 90% POINT, FEED, AND PRODUCT: How does the 90% of the feed affect reformate octane, and the 90% of the product and yield at constant R.v.p.?

KILLEN: I think there are two answers to that. It is our experience that the instantaneous effect on octane would be to give you a little higher octane at the same operating conditions if your 90% point is raised. But, if you are looking at it over the long run, you are going to lose in octane, because you will deactivate the catalyst faster and so, for say a given run, you will get better catalyst life, or if you are comparing it at the same temperature, better octane if you reduce the 90% point of your feed.

The 90% point of the reformate will vary as the 90% point of the feed does. As the 90% point of your feed goes up, the 90% point of your reformate will go up accordingly. The amount that it will increase depends on the severity of the operation. As your operation gets more severe, there will be a bigger spread between the 90% point of your reformate and of your feed.

HAIG: I don't think I have much to add—except to mention that this long term effect in cycle length does not apply to the regenerative units such as you have here. You can stand the increased deactivation in a regenerative type unit.

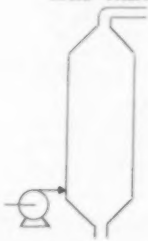
WOMELDORPH: We found that the yield and the reformate octane are relatively insensitive to variations in the 90% point for a 225-250 initial, 350-400 e.p. stock. This is about what you would expect, since the Pona of the tail end of most stocks normally doesn't change too much with cutting of 25° or 50° off the 90% point. This seems to check out for the stocks which we have looked at, definitely, along this line. I agree that the 90% point will go up with the 90% point in your feed.

HARTMAN: I have some quantative data here on increase of 90% e.p. versus severity. At the 92 level, the increase is about 7°; 98 level, 17°; 104, 27°.

WALK: Ben, were those clear numbers?

HARTMAN: These are leaded-octane numbers.

ACID TREAT



ACID TREAT: Is acid treating being used successfully to remove arsenic, lead and sulfur from catalytic reformer feed stocks? If so, what improvements in catalyst life and yield-octane have resulted? What problems have been encountered?

KILLEN: Mostly, I would refer you to an excellent article put out by Ohio Oil and Petreco on this subject. I think it was published in the September 1957 issue of the Petroleum Refiner. It relates Ohio Oil's experience with this type of operation, and points out quantitatively what they did achieve. The Ohio Oil co-author of the article is here today, if anybody is interested in specific information from their operations.

EPPARD: We've been using an acid treater on our reformer charge stock now, for over a year, and we're using it mainly to remove the arsenic. We treat the reformer charge with from a half pound to one pound of H_2SO_4

acid per barrel and the unit does a good job of removing arsenic.

I think the second part of that question was about the troubles we've had. Our biggest source of trouble has been from trying to get a pump that will pump small quantities of sulfuric acid. We have had solids in the acid which plague us by plugging our suction lines and fouling the valves on the pump. At present, we're using a mercury type pump, with mercury seal, but it does not work too well.

At one time we had the electrodes fail on our precipitator and got some acid carry-over. After the acid treater we go through a clay tower as a guard chamber and when we had the acid carryover we got some clay into our charge pump which caused us some trouble.

A typical arsenic removal by the unit, with a charge stock of approximately a hundred parts per billion, we average about 8 parts per billion in the treater-effluent removal. The raw charge has about 0.028 wt.% sulfur and this is reduced to 0.014 wt.%. The sulfur removal ranges from 50 to 30%. We have had some lead in our charge stocks and the acid-treating unit will remove the lead. Our reformer charge stock and severity levels at which we operate vary so much that we can't make an accurate statement on what improvement in catalyst life this unit has given us.

KILLEN: I think Jack Eppard's experience is on a virgin stock, and I think this treating method may have application to somebody who is treating a cracked stock, as in the case of Ohio Oil; if they want to avoid going to high pressures in their desulfurizer to remove nitrogen. This method has exceptionally good nitrogen-removal ability.

You would expect it to take out the basic nitrogen, but, it also appears to remove most of the total nitrogen down to around a 2-part per million level. So, it's worth considering as a means of avoiding going to high pressure in your desulfurizer or in helping your desulfurizer if you have a low pressure unit and are running into trouble with nitrogen.

EPPARD: There is only one thing I didn't mention. When we first installed this unit we checked our operating costs and found they will range from 1¾ to 2½ cents per barrel. That includes royalty and all the other operating costs.

KILLEN: Have you noted any effect on preheat-exchanger fouling, with and without acid treating? Does it do anything to improve the fouling situation?

"Does it . . . improve the fouling situation?"

MADDOCK: (Ohio Oil Co.) I shall try to clarify our particular position in regard to this acid treater. We had an extremely small guard case which was designed for platinum—primarily for desulfurization. But with the coker naphtha in it did not adequately remove the nitrogen which was found, and there was also a substantial arsenic problem in our feed.

We elected to try this Petreco acid-removal unit for nitrogen removal, primarily after we had found that by substitution of cobalt and molybdate for platinum we solved our arsenic-removal problem adequately. We got excellent removal of nitrogen on the acid-treating unit, say 97 to 98% and substantial removal of sulfur in the order of 50%.

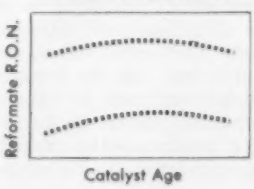
We put coker naphtha in under a couple of different conditions. The longest run was about 1 month while we were operating in the order of 94-95 clear. As far as the results on the fouling problems, there was no noticeable improvement. It was in only for a month and I can't say that it improved it.

However, to clarify the whole situation regarding the effectiveness of the nitrogen removal, this small guard case that we have has a space velocity in the order of 20, and when using cobalt and molybdate this is extremely high. It only gave about 30% saturation of the olefins.

So we ended up with about 3% of olefins to the reactor charge. Whether this was the largest contributing factor, or whether it was the fact that there are some acid oils which may not be completely removed in the acidizing wash, we did get a marked increase in deactivation when we ran with the coke naphtha in the order of 10 to 12% of total reactor charge.

So, because of the increased coke laydown on the catalyst, we removed the coker and have not run it since. So, we don't feel that we can definitely give a complete recommendation against the acid wash.

CATALYST LIFE S.R. VS CRACKED NAPHTHA



CATALYST LIFE: Is there an appreciable difference of catalyst life when charging catalytic or thermal-cracked naphtha to a Platformer instead of straightrun naphtha?

KILLEN: I assume that this means with pretreating of the naphtha first. Certainly if you weren't pretreating the cracked stock you would have a very short life. I don't think our experience would indicate that there should be any significant difference. Your coker naphtha will look worse from the standpoint of naphthenes than your virgin naphtha from the same crude.

But, about half of the olefins that show up in that cracked naphtha will be cyclic and will hydrogenate going through the pretreater to naphthenes. So you come out in the end with just about the same sort of stock as your virgin feed was. Perhaps I shouldn't make a sweeping statement—that's the way it works out with us. I have seen some indication that other people's coker naphthas are poorer feed stocks than the virgin.

HAIG: I would just back up what Jay said; maybe you should find someone who has found a difference.

WALK: Charlie McMahan, do you have any comment?

McMAHAN: No, same story—with proper feed pretreatment, same catalyst life.

WOMELDORPH: We have some tests on straightrun material and coker naphtha from essentially the same crude source, and for this stock the paraffins, after hydrogenation of the coker, were about 40% on the virgin stock and 50%, or a little higher, on the hydrogenated coker. So, it looks like the coker is not as good a charge stock, on this particular material.

REPLACING CATALYST CHLORIDES: What has been the most successful compound used to regain catalyst chlorides that may have been lost due to water carried in the reactor charge? How much is used on a volume basis with reactor charge?

JONES: We have used, quite successfully, propylenedichloride. We haven't tried anything else, although I have heard that there are some other or-

ganic chlorides that would probably be equally successful. We use approximately 600 cc. per day, when running about 3,000 bbl. per day of charge.

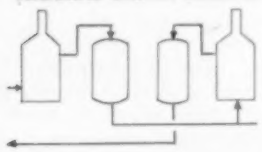
We have about a 35° F. cloud point on our Platformer feed stock and, as I recall, that's something in the neighborhood of 15 p.p.m. of water. We attempt to control the amount of propylenedichloride added to maintain 2 to 3 p.p.m. of organic chloride in the charge. In other words, that would include the organic chlorides in the feed stock, as well as the propylenedichloride added.

KILLEN: We differ a little bit on the best chloride level, I think. Our pilot plant has shown that any organic chloride is equally successful and we would back up Bruce's experience that the chlorides and the water are intimately tied together. I think the optimum level, if it could be established, would be a continuously changing thing as the age of your catalyst changes.

But, that is only my opinion—we don't have any good data to back it up. We believe, from both our pilot plant and the plant operation, that a ratio of 1 and 1½ p.p.m. chloride on feed, to about 50 p.p.m. water in the feed, is a good spot for us to operate.

EPPARD: We have used ethylene dichloride and we are now using propylenedichloride. We have not found any difference. We add about 0.025 wt. % chloride ion per day, based on the weight of the catalyst charge. We've gone up as high as 0.033, depending on how the unit looks and how much hydrocracking we're getting.

NATURAL GAS IN STARTUP



NATURAL GAS IN STARTUP: Has anyone used natural gas extensively when starting up reformers instead of hydrogen; if so, were any bad effects noted?

WALK: We are presuming that they are talking about Platformers here, because, of course, on a regenerative process they start up on natural gas all the time.

KILLEN: On the initial start up, with fresh catalyst, we believe it safer to keep away from the natural gas. Because, there may be some poisons in it and with the highly reactive catalyst, regardless of whether there are any poisons, there is a certain danger of hydrocracking the natural gas that you don't have with the hydrogen.

So, we prefer to stick to electrolytic hydrogen in starting it up, especially for the first time. I think that if you were down for some reason, and that catalyst is then less active, that there should be no major problem in starting up with natural gas. Now, I'm not sure that UOP agrees with this.

McMAHAN: We use hydrogen.

HARTMAN: One of our refineries is using natural gas in the testing-out stage before the unit is brought on stream. We go up to full operating temperatures and pressures and then release it.

WOMELDORPH: We've had some experience similar to Ben Hartman's statement. We have several people who have used natural gas for the initial testing and drying period. We have also had some who, because of not having sufficient quantities of hydrogen to get the plant on stream, have actually diluted their hydrogen with a percentage of natural gas. In none of these cases have we found any difficulty that we could attribute to the use of the natural gas.

WALK: It looks like it can be done. It's one of those things where it might be better to have the hydrogen, but we can do it with natural gas.

CORROSION: What corrosion has been experienced in catalytic-reforming units? Also in desulfurizers?

CORROSION

How 31 companies fight corrosion in cat reforming

by
E. B. Backensto
The Oil and Gas Journal

KILLEN: Our own experience has been that we've had very little corrosion in the Platformer. We have a 3-year-old Platformer and a 1-year-old Ultraformer and we haven't had bad oil-side corrosion in either unit. We've had some in the Platformer desulfurizer section, in the stripper or depentanizer tower.

In both units there has been some corrosion in the stabilizer. We also have some corrosion in the feed effluent exchangers in the desulfurizer section but it is not all the result of onstream operation. We have to clean them so often that we remove a little metal in cleaning.

There is an experience of another refiner that may be of some interest. He had his unit on stream for 2 months and lost all of his coolers and condensers in the desulfurizer section with chloride corrosion. He was feeding a full-boiling-range stock of about 100° to 400° F. and it is his belief, which I don't think he has effectively confirmed yet, that he is getting these wellhead solvents that you read about —chlorinated solvents—in the naphtha, and that they are concentrating in the light part, the 200 part of the feed.

That's why he is getting a worse problem than a lot of people have. I don't know if that is true, but, it is something that we are seldom concerned about though we are looking to see if there is a high chloride concentration in the light stock. If it is near the place where you are cutting the initial on your reformer feed, it would pay maybe to move one way or the other as necessary to get away from the chloride.

EPPARD: We've had, off and on, more or less all of the chloride corrosion problems. We had them in the overhead condensers, on our stabilizer, and on the feed exchanger and on the effluent coolers. When we have a lot of water in the feed the corrosion will start showing up pretty bad. However, we have been able to use inhibitors and stop most of it.

On our overhead condenser we used Polyrad and ammonia very successfully. We are still getting corrosion in our feed exchanger and we started using some inhibitor at this spot but can't tell yet how much good it is doing. In our effluent cooler, where condensation starts, we get a lot of chlorides. We have chewed out some tubes and we are considering putting in an inhibitor at that spot.

ANDERSON: We've had, roughly, the same experience as far as chloride corrosion goes. Our worst spot was in our effluent coolers. About 3 months after we were on stream, we started getting a small leak around the back head of the cooler. We tightened it up and about 3 days later it was leaking again. We couldn't tighten it enough to stop it so we shut down and

"We have a terrible time . . ."

found just about the whole head was eaten out.

At that time we hadn't been adding, or injecting, any water or inhibitor, or anything. We didn't have any particular signs of having too much moisture in the system, but apparently we had enough to carry a little chloride. We built the head back up and put a monel lining in the head. There is also a 10-in. line off the bottom of this particular head, elled out to the side and then elled up. We lined those two ells and then the small horizontal piece of pipe between which had been eaten up pretty severely. We had to get back on the line before we could do anything about making provisions for withdrawing water at our separator so we continued to operate that way for several months, until we took a regular turnaround.

During the turnaround all the monel parts were in good shape. We had a little corrosion a little further along the line. We replaced a section of the line and then we added a water draw pot on our product separator and now we inject, I believe, around 19 gal. of water an hour between the two effluent coolers. We also add, roughly, a gallon of DEA and a couple pints of Kontol at that point. We add enough DEA to adjust the pH on this water between 6.5 and 7.5. Without the DEA addition the pH would run 1 or 2—this is pretty potent. Since we have been doing that, we feel we have been getting along pretty well. The iron content of the water is fairly low.

About the same time, we had some trouble in our stabilizer feed exchangers. We bring our reactor products and a stream of light straightrun gasoline together and then stabilized them. We were using an ammonia injection to protect the overhead system on this light straightrun. It contained a little water with a little ammonia and with the chloride that was coming through with our reactor products, we got quite an ammonium chloride deposit in our feed exchanger and, also, some corrosion at that point.

Going back to Jay Killen's comment about chlorides showing up in light gasolines in the order of 250° F. e.p., we apparently got a shot of crude oil that contained quite a bit of carbontet, or some such material. We were going along and our chlorides jumped up something like 16,000 p.p.m. on the overhead of our stabilizer. Of course, the pH was way down and we were adding a combination of ammonia and Polyrad.

To get the pH back up we just gave it a good shot of about 35 Baume caustic and got out of that. That one little siege gave us quite a bit of corrosion as noted at our next inspection. We had a similar problem on our effluent coolers on our Unifiner. We inject about 57 gal. of water an hour at that point, along with a little inhibitor and it has stopped that corrosion.

HARTMAN: I would like to back you folks up here on your observations on chloride distribution in the straight-run naphthas. I wonder if it wouldn't be well to go talk to our producing friends like a father and see if they could get something done about it.

WOMELDORPH: At the midyear meeting of the API in Philadelphia this spring, the subcommittee on corrosion presented a compilation of the corrosion experiences on catalytic reforming of about 31 different companies. That committee was headed up by Mr. E. B. Backensto, who wrote this report (The Oil and Gas Journal, May 20, 1957, p. 180).

KILLEN: It may not be corrosion, but our biggest problem on our two units is the compressor maintenance. On the Platformer, we have a reciprocating recycle compressor and on the Ultraformer our inert-gas circulators are reciprocating compressors. We have a terrible time keeping those machines running. I wondered if anybody has had a good experience in meeting this problem by using any special composition valve plates, or going to anything else which would beat the problem of chloride embrittlement or whatever is causing this breakage.

EPPARD: In our unit at Duncan, we have had a lot of chloride carryover into the compressor and fouling the valves on the compressor. We originally had an amine glycol tower there for scrubbing our recycle gas which we had not been using. We started using this tower to water wash the recycle gas. That cured most of our problems with the chlorides. However, we have been getting some serious chloride corrosion in the water section of this tower.

ANDERSON: We went through this compressor problem. We tried several types of materials and did not have much success that way. But, when we started doing all this water washing and neutralizing with DEA we started getting up to four to eight times the time between cleaning valves. It really improved on our Unifiner compressor particularly. The thing used to be about every 2 weeks or less. Sometimes we would change valves and this last time we put the unit on in May and day before yesterday we changed our first valves on it.

McMAHAN: Back to the general statement on corrosion. A review of the operating records of those Platformers which have been on stream now more than 3 years, and by now of course there are quite a few of those units, reveals that in those units which have had more than very mild corrosion, the difficulty has at each time been with wet feed stocks or feed stocks contaminated with organic chlorides.

WALK: Is there a simple test that you can make for this chloride that would be worthwhile to run as a routine analytical check on your feed?

McMAHAN: I'm afraid chloride determination is not quite as easy as a "go-no-go" test that could be run at the operating unit. It is an analytical procedure and, if properly followed, gives precise numbers.

FORBES: (Ohio Oil Co.) I would like to say that within the next few months, in a corrosion magazine there will be an article prepared by Jerry Cyrel of Kellogg and presented at the National Association of Corrosion Engineers on his findings of surveys of a number of groups of different refiners as to what their corrosion has been in Reforming units.

MEASURING HYDROGEN

MEASURING RECYCLE HYDROGEN: What type of instrument is used for measuring hydrogen content of recycle gas in catalytic reforming? (1) What accuracy is normally experienced? (2) What laboratory analytical procedure is used as a standard?

BYRNE: What we are doing is using a Hays Condutherm analyzer for determining hydrogen. It works on the difference in thermoconductivity between hydrogen and hydrocarbon gas,

"I have just the opposite report. . ."

such as methane. We aren't too satisfied with the way it checks our laboratory results.

Ordinarily we get a meter reading in the order of 10 to 15% lower than what the laboratory gives us. The laboratory determination method is the common combustion method, wherein the gas is passed over a cuprous oxide catalyst in a closed tube at 300° C.; the hydrogen converts into water, condenses, and reads directly in volume as per cent hydrogen.

KILLEN: I have just the opposite report on the same instrument. We use a Hays in the pilot plant and they like it better than the laboratory results. They feel that they get better reproduceability and more reliable results with this Hays hydrogen analyzer than they do on the mass spectrometer. They check it against the MS which they feel is reproduceable ±1% hydrogen and they get better results, they feel, on the hydrogen analyzer. They run the units pretty much by this.

EPPARD: In our plant we use the Schilling apparatus and in the laboratory we use a mass spec. They check within about 1 or 2%. However, we did have quite a bit of trouble with the Schilling until they set up a routine cleaning program on this apparatus.

HEIKE: (Premier Oil Refining) We've had a Platformer at our Fort Worth plant since 1951 and at that time there was a proposed hydrogen analyzer which never worked out too well. So, we bought a recording gravitometer, put it on the recycle gas stream and it has done very well by us. An empirical curve, using Podbielniak analysis, was drawn relating volume per cent hydrogen to specific gravity. It indicates very quickly, and positively, any change in the operation. We put another one in the second Platformer we just started up at the Longview plant this year. It's a Refinery Supply instrument, recording the gravity of the recycle material. It does very well.

WOMELDORPH: We have also used the Ronarex type of gravity recorder. Of course you have to have the calibration curve as just mentioned here with the other type. I think that it is probably in the same price range. It's a rather rugged instrument, so we feel that it is probably better than the hydrogen recorder from that standpoint.

EPPARD: I might mention, of course, we are getting good results measuring 89% hydrogen and higher. If we had to measure lower purities our results might not be as good.

CATALYST POISONS: In the order of their importance, what are the principal poisons of reformer catalyst? What are the principal limits?

CATALYST POISONS

KILLEN: It depends a little bit on what we are actually considering as poisons. To us, as far as our nonregenerative unit goes, the worst poison we have is coke. We have a desulfurizer that takes out the other poisons and we just can't do much about the coke building up, eventually. I think probably the question refers to the more commonly referred-to poisons, arsenic, which is a deadly poison—it's probably as bad as any of them.

Sodium, I think, is just about as bad; lead you can tolerate in a little larger quantities. Nitrogen and sulfur are both temporary poisons which, while they are there, will depress the activity of the catalyst. But, they will come off either with regeneration, if it is a regenerative unit, or if you change the operations.

So, if you don't have any sulfur or nitrogen in the feed, you get rid of the nitrogen and sulfur on the catalyst. We have already mentioned water and chlorides—they are both poisons if they are there in too great a quantity. As far as specific numbers on how much you can tolerate, I think some of the licensors would be better qualified than I to answer that part of it.

ANDERSON: I have about the same list of elements. I don't know if he mentioned copper or mercury. They're both fairly poisonous items. In our particular case the arsenic is by far the worst, and we feel that in the order of 4 to 7 parts per billion is where you would start getting into trouble. We have had shots as high as 30 parts per billion, which will really kill it off in a hurry. It's definitely permanent too.

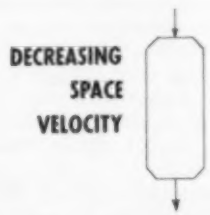
HARTMAN: We've had quite a lot of trouble with arsenic, in particular. Although I cannot say positively, we have the impression that with any kind of concentration of arsenic on the catalyst exceeding 200 p.p.m. in the first reactor, you're apt to have a change in sensitivity of the catalyst, as well as a tendency to go dead.

It removes the arsenic almost quantitatively. We've experienced concentrations as high as 1,000 p.p.m. on the catalyst. You'll have a band effect, generally with higher concentrations at the top and it tapers off as you reach the bottom. I was thinking in terms not to exceed 200 p.p.m. at the bottom at which level you're apt to have a pretty serious breakthrough.

McMAHAN: Well, my list would read just about like everyone else's here. This question becomes tough when you try to specify limits. Because for each individual feed stock, each individual situation, one plant can tolerate more or less contaminants than others. The list, as I had it, reads "Arsenic, other metals such as lead and copper, then nitrogen, sulfur, water, chloride."

Coke formation in a reforming unit not requiring regeneration is maintained at a low level with adequate hydrogen circulation. Of course, after extended period of time, coke formation may dictate a catalyst change. Whether coke should be removed by cyclic regeneration, by infrequent in situ regeneration, or by catalyst replacement, is a question of economics which has been evaluated many times in the last 3 years.

COMMENT: The secret of good reforming operation is probably to maintain all these contaminants as near zero as possible. That possibility, of course, depends on the economic considerations of the individual refiner. If anyone is looking at a reformer to install, he should evaluate pretreatment also.



EFFECT OF DECREASING SPACE VELOCITY: Disregarding quantity requirements, what is the relative merit of decreasing space velocity rather than increasing temperatures as a means of increasing octane?

KILLEN: It's our experience, based mostly on pilot-plant work, that we can interchange space velocity and temperature without affecting yield. This is an instantaneous yield. But, over a period of time if we go high in space velocity and, therefore, go up higher in temperature we will deactivate the catalyst faster and go downhill faster in yield.

HAIG: We all recognize that this can cut down on your yield because you want to dehydrogenate the naphthenes at a moderately low temperature before they start cracking. It is preferable in the first reactors to keep temperatures lower than in the end. As for the downstream reactors, a lot depends on whether you have a regenerative process. With a regenerative process, you can afford to deactivate more rapidly although you would have to regenerate more frequently, and possibly shorten catalyst life.

WOMELDORPH: We don't see that there is any merit yieldwise in substituting a lower space rate for a higher temperature, since Houdriforming catalyst has characteristics which tend to allow the use of higher temperature without loss of selectivity. This is true over the normal reforming range of about 900° to 975° F.

INERT-GAS BLANKETING: What experience have others had in regard to the effect of inert-gas blanketing or reformer-feed storage?

McMAHAN: Properly gas-blanketed feed tank with virgin stocks have eliminated nearly completely any feed-exchanger fouling. This inert-gas blanket, however, is not completely effective in eliminating feed-exchanger fouling when operating with extremely thermal-sensitive stocks, such as some of the coker gasolines and vis-breaker gasolines. Thermal-cracked gasolines have not given as much difficulty as coker and vis-broken stocks.

If either coker or vis-breaker stocks can be fed directly from processing units to either the Unifining pretreat section or directly to the Platforming unit, feed-exchanger fouling is not a serious problem. On the other hand, however, when coker and vis-broken stocks are allowed to be stored for long periods of time, even in gas-blanket storage tanks, we have had difficulty.

KILLEN: We agree—get the oxygen out and keep it out if at all possible and get the feed to the unit as fast as possible. If you can't go direct, use gas blanketing. We know that

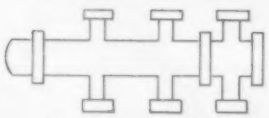
"Get oxygen out and keep it out . . ."

floating-roof tanks aren't the answer. We don't know yet in our case whether floating-roof gas-blanketed tanks are. We're trying that at the present time. We have about 10% coker distillate in our stock and we feel it is the bad actor.

EPPARD: We have charged a 100% virgin stock and we have had our exchanger plug up but it was because the gas blanket was not on the tanks. After we got a gas blanket back on the tank and the exchangers cleaned up, we didn't have any more trouble. I might mention that it appears that this fouling starts when the temperature gets to about 500° F.

Along this same line we had this trouble on our cat cracker feed exchangers. We eliminated this trouble by putting in an oxygen stripper on our gas-oil charge. Before the stripper, we preheat some of our cold feed stock to about 200° F. and we don't have any fouling on this exchanger.

EXCHANGER FOULING



Fouling resistance -0.005

EXCHANGER FOULING: I wonder if anyone that has had a fouling problem in their feed-effluent exchangers in the desulfurizer or in the other exchangers, if you don't have a desulfurizer; if you have anyone that's gone from a 4-6 chrome, say, to an 18-8 and cut down on the extent of the fouling—or had a less happy experience?

HARTMAN: On one of our units which does not have a pretreater, we have gone to 18-8 on the feed side to eliminate the problem. Our opinion of the real answer to this thing is to eliminate your storage tanks.

COMMENT: These cases of feed exchanger fouling—has that been happening where people have been charging a side cut from a prefractionator?

COMMENT: Yes, we charge this one stream as a side-cut off a coker bubble tower. Ours is virgin material, but we have assumed that it would not be due to oxygen, since this side cut runs at 340° F. and the tower that's operating at about 25 lb. pressure. Unfortunately, we also have had a crude stream run down into the same tank and this crude stream could carry oxygen with it, so in tankage they're mixed together—the oxygen from the virgin naphtha, with the coker distillate and we have a nice setup for fouling polymerization.

COMMENT: Our storage is not gas blanketed—we come to storage to a prefractionator though and then to the reactor section.

WOMELDORPH: We have had some indications this fouling trouble may be tied in with sulfur, as well as oxygen or maybe the fact that the two are there together, tends to make it worse than if they were there separately.

CURRIN: I might just say a word to bring you up to date with Atlantic's experience on nitrogen blanketing. Last year, I believe, some of our fellows mentioned that we had had success by putting nitrogen on a couple of floating-roof reformer-stock tanks. Both tanks had a vapor space under the deck and by putting nitrogen at that point we solved our problem. In applying this blanketing, we found that we were getting nitrogen leaks from the tank. In making a closer inspection, we found that the trouble was some unnoticed corrosion at the vents on the deck.

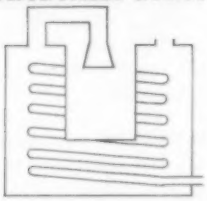
In sealing these to keep the nitrogen on we apparently kept the tank from having any opportunity to breathe air into the dead vapor space that was below the floating-roof deck. At that time, however, the operation was so inexpensive that we didn't feel justified in cutting out the nitrogen, so we continued to add something on the order of 100 cu. ft. of nitrogen per tank per day.

We have since found in the last few months, that we could cut the nitrogen out and the fouling has not gone up. So, we feel that the answer to the problem was to properly seal any vapor space and keep oxygen out. The hydrocarbon forms its own blanket under those conditions and you seem to get out of a fouling problem. That stock has no cracked products in it.

We have recently started up new units which are charging cracked stocks, and we are using floating-roof tankage on that feed stock. In this case we have the double-deck construction which has no vapor space below and we're not putting any nitrogen in at the present time. Since the unit has only been on roughly 2

months, we can't report to you at this time whether the cracked stock is going to get us back into a problem.

GUM IN DESULFURIZER CHARGE



GUM IN DESULFURIZER CHARGE: What test is used for gum in desulfurizer charge naphtha when processing straightrun-plus-cracked stocks? (1) What is considered to be a tolerable level? (2) What protective measures are used in intermediate storage to minimize gum formation?

McMAHAN: The test which I have used a few times and which seems to give some sort of a qualitative answer is to run a typical ASTM gum on the material containing cracked stocks. Then run that same ASTM gum, substituting steam or nitrogen for air. Those heat-sensitive stocks will have a much higher ASTM gum when determined in the usual manner with air evaporization than when determined using nitrogen or steam. Those heat sensitive stocks have been the ones which have given us the major trouble in this feed exchanger fouling.

KILLEN: Another refiner's experience has been with uncracked stocks. If they can keep the regular ASTM gum level down to five by juggling their stocks around, then they will not have a fouling problem. If it gets above that, they get into trouble. That's one person's number as to where he operates.

PRESSURE DROP—DESULFURIZER BEDS: What causes have been found for pressure drop and particularly rapid rises in pressure drop through desulfurizer beds?

HARTMAN: We had several instances where we found considerable amounts of iron sulfide on top of the desulfurizer bed. We have tried to solve the problem in two ways. One is to use proper alloys in the piping ahead of the reactor, and the other was the installation of small circular baskets on top of that.

HAIG: I think that the most common one we have experienced is the scale coming from upstream piping and causing deposits on top of the bed. Another possibility is when you suddenly get a high amount of cracked stock in your charge it can develop coke very rapidly. Sometimes that will form so rapidly as to create a pressure drop in the bed. Of course, that can be overcome by regenerating the bed.

WHAT'S BEING DESULFURIZED: What types of oils are being desulfurized with reformer hydrogen? Are oils such as kerosine or diesel fuel being desulfurized with hydrogen?

McMAHAN: At the present time, there are units in commercial operation which are desulfurizing everything from heavy-fluid coker gas oil up through the kerosine and gasoline boiling range. The fluid and vacuum heavy gas oils are desulfurized for catalytic cracking feed pretreatment.

Diesel fuels and kerosines are being Unifined for improvement in product quality, primarily sulfur reduction, though other benefits, such as improved color, odor, and stability are achieved in the Unifining treatment. Of course, at the present, the greatest installed desulfurization capacity is catalytic reformer feed pretreatment.

HYDROGEN CONSUMPTION: What is the hydrogen consumption in desulfurization versus the charge stock unsaturation when including increasing amounts of such stocks as coker naphtha or thermal-cracked gasoline?

COMMENT: For nitrogen and sulfur, of course, you calculate it reasonably easy unless you're out on the West Coast where the nitrogens are high. There's very little, almost negligible, hydrogen consumption to remove nitrogen—maybe a maximum of 2 cu. ft. per bbl. If you go up as high as 1.0 wt. % sulfur on feed, it's up in the range of 100 to 150 cu. ft. per bbl., per cent sulfur.

But generally, I think you would calculate it out chemically as to how much you would use. I don't know the answer to this cracked gasoline except from our own experience. It looks like that with a bromine number of about 10, we used from 80 to 100 std. cu. ft. per barrel.

ANDERSON: We have processed a coker distillate—it ranges from initial of around 100° F. to an end point of close to 600° F. On this particular material we use as high as 250 to 270 cu. ft. per bbl. That's fairly low sulfur material — it has about 0.13% sulfur. The bromine number at the start on a reactor charge is about 50 and this material is split into two cuts.

After it's been treated, the bromine number on a material that's about 376° to 600° F. is about 1.6 and on the light material which is about 115° to 350° F., bromine number is about 0.7. You may be interested in the effect on the octane number of this material. We checked the octane on a 400° F. e.p. material obtained from a Himple distillation.

The octane was 69 clear and 83 leaded. On the 350° F. e.p. material, after Unifining, the clear number was 44.5 and leaded number was 69. So that you improve the susceptibility but you take an over-all beating on the actual octane number.

HAIG: I have a number that seems to fall right in between what has been given here for bromine number. We have a rule of thumb which says to use 7 cu. ft. per bbl. per bromine number reduction. Of course, you add to that whatever you have for sulfur, nitrogen and mechanical losses in the unit.

WOMELDORPH: I have something that might add to this business of increasing the quantity of coker naphtha. I recently obtained a number from a plant that is desulfurizing both straightrun and coker naphthas and it shows a hydrogen consumption for the coker of about five times that of the straightrun.

KILLEN: I think this matter of octane reduction, on going through the dehydrogenation unit, will depend somewhat on the space velocity. If you can get desulfurization and denitrofication at a fairly high space velocity, you won't hurt your octane number as much as if you were going through slower.

HAIG: We also treat cat cracked naphthas very mildly just for stability improvement, with very little change in sulfur, and essentially no change in leaded octane number.

Note: The concluding article of this series will deal with alkylation and miscellaneous problems. The articles are based on a panel discussion at the WPRA regional meeting at El Dorado, Ark. Parts 1 and 2 appeared in The Oil and Gas Journal on March 31 and April 7, 1958, respectively.

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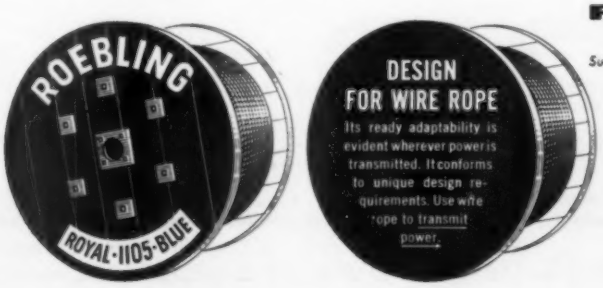
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BY W. L. NELSON
Technical Editor and
Petroleum Consultant

Effect of completeness of processing on

Steam and fuel requirements

TABLE 1 indicates the general effect of completeness of refining on the steam and fuel requirements of 30,000-bbl. per day refineries operating on average 34.5° API crude oil. These types of plants are contemplated:

A. Topping, thermal cracking, and polymerization.

B.* Topping, catalytic reforming, thermal cracking, and polymerization.

C. Topping, reforming, catalytic cracking, and polymerization.

D. Topping, reforming, viscosity breaking, catalytic cracking, polymerization, and alkylation.

E.*† Average United States refinery (1955).

F. Same as D except process for 16.5% of lubricating oil and wax.

G.* Lubricating-oil refinery operating on reduced crude oil.

*See Processing Costs next issue of this series.

†Refer to Process Costimating No. 9 (April 21, 1958, p. 177).

Schedule of Series

12—May 12, 1958—Fuel and Steam—A Lube Refinery
13—May 19, 1958—Steam and Electricity Requirements
14—May 26, 1958—Cost of Purchased Electrical Power
15—June 2, 1958—Cost of Cooling Tower Water
16—June 16, 1958—Water Costs
17—June 23, 1958—Cost of Reuse of Steam

The steam and fuel requirement for each unit were estimated from Tables 1 and 2 of Process Costimating No. 8 (April 14, 1958) p. 129). Once-through catalytic cracking was contemplated in Plant C and an increasing intensity of catalytic cracking by recycling, in Plants D and F. It was assumed that the air blowers and gas compressors in some of the cracking plants were driven by gas or diesel engines, and this explains the meaning of the fuel items entitled "for engine drives."

The last line of Table 1 shows the heat required for direct-fired heaters and engine power but it does not include the heat used in generating steam (or electricity). Fuel and steam requirements are somewhat related to the sums of the amounts of oil handled in all of the processing units.

These plants will be compared with other plants in Process Costimating No. 12 (May 12, 1958).

TABLE 1—APPROXIMATE EFFECT OF COMPLETENESS OF PROCESSING ON FUEL AND STEAM REQUIREMENTS (PER BARREL) OF 30,000-BBL. PER DAY REFINERIES OPERATING ON 34.5° API CRUDE OIL*

	A—Cracking and polymerization			C—Reforming, cat cracking and polymerization			D—Reforming, cat cracking, visbreaking, poly., and alkylation			F—Same as D except lubricating oil manufacture		
	Cap.† (%)	Heat, M. B.t.u.	Steam (lb.)	Cap.† (%)	Heat, M. B.t.u.	Steam (lb.)	Cap.† (%)	Heat, M. B.t.u.	Steam (lb.)	Cap.† (%)	Heat, M. B.t.u.	Steam (lb.)
Topping	100	55.0	45.0	100	65.0	55.0	100	65.0	55.0	100	60.0	47.0
Percentage vaporized	(57)	...	...	(80)	...		(80)			(63)		
Cat reforming	...	...	...	21	34.5	15.7	21	34.5	15.7	21	34.5	15.7
Cracking	42.5	204.0	19.1	...	...	...	...	...	...	...	...	...
For engine drives	20.0	3.0	...	...	...	...	...	...	...	...	...	...
Visbreaking	...	...	...	...	...	...	20	38	6.0	10	10	3.0
Cat cracking	...	...	...	32.5	200.0	27.6	47.5	292.0	40.4	29.5	182.0	25.1
For engine drives	...	...	...	10	3.3	...	15	5	...	13	4.3	
Polymerization‡	‡1.5	2.9	1.1	‡1.9	3.6	1.4	‡1.7	3.2	1.3	‡1.1	2.1	0.8
Alkylation‡	...	...	...	...	...	...	‡2.9	0.4	19.1	‡2.4	0.3	16.3
Light-oil treating§	26.0	...	7.8	20.0	...	6.0	33.0	...	10.0	28.0	...	8.4
Lube manufacture:												
Dist. and rerun	...	...	...	...	...	...	...	...	...	62.0	105.0	93.0
Solvent extraction	...	...	...	...	...	...	...	...	...	25	35.5	32.5
Solvent dewaxing	...	...	...	...	...	...	...	...	...	25	...	75.0
Lube finishing‡	...	...	...	...	...	...	...	...	...	‡15.0	23.5	15.0
Wax finishing‡	...	...	...	...	...	...	...	...	...	‡1.5	1.6	4.8
Totals	...	265.0	71.0	...	306.0	106.0	...	438.0	147.0	...	468.0	337.0
Relative handling¶	285.0	...	...	205.0	...	...	300.0	...	...	456.0	...	...
Coke credit	...	...	...	...	24.0	...	...	38.0	...	...	28.0	...
Heat required (not including steam)		265.0			282.0			400.0			440.0	

*Subject to correction as the Process Costimating series continues. †Feed stocks, per cent of crude-oil capacity. ‡Finished products, per cent of crude-oil capacity. §Only cracked gasolines and kerosine. ¶Major process units, including recycling and some storage transfers.

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Tests for contamination

BY J. C. DINGMAN and R. P. MONAGHAN

MONOETHANOLAMINE by Kjeldahl will give the total nitrogen regardless of its form. If nitrogen from a source other than monoethanolamine is known to be present, the Kjeldahl value is corrected for this and the remainder calculated as monoethanolamine. The difference between this value and the Van Slyke value is a gage of the degradation products of monoethanolamine which are present.

In a good solution, all three values for monoethanolamine will be the same, within the limits of accuracy of the methods of analysis.

A similar analysis is applied to diethanolamine solution, the Van Slyke method being replaced by a method for diethanolamine.

For monoethanolamine solutions, a test called **"Residue on Steaming"** is run as an empirical check on the monoethanolamine by the three methods above. In this test, a sample of filtered solution is boiled down, steamed, and brought to near dryness to determine the amount of nonvolatile material present.

These tests indicate the need for introducing or improving solution reclaimer operations.

Thiosulfates, thiocyanates, and **formates** are determined to learn the extent of contamination by these compounds.

- **Insoluble material** in the solution is abrasive to metal surfaces. A measure of the insolubles will indicate the need to install or improve filtration.

- **Monoethanolamine content by acid titration** will give the total monoethanolamine available for pickup of acid gases.

- **Monoethanolamine content by Van Slyke** will give the total primary amine present. The difference between this value and the value from titration will be a measure of the monoethanolamine combined with acidic materials to form stable compounds.

Solutions known to contain soda ash are subjected to a flame photometric analysis to determine **sodium content.**

Iron content gives some gage of the corrosiveness of the solution. Iron content should probably be less than 50 p.p.m., and commonly will be less than 20 p.p.m.

Iron acceptance is an empirical test to gage the corrosiveness of the solution. Values of 100 p.p.m. as iron will be determined on good solutions. Values of 1,000 p.p.m. or greater will be determined on corrosive solutions.

Qualitative tests for oxidation products of monoethanolamine (i.e. aminoacetate, glycolate and oxalate) will augment other tests for corrosiveness of the solution. They will also assist in fixing the cause of corrosion; their presence being indicative of deterioration through oxidation.

Authors are with Jefferson Chemical Co., Houston. From paper presented at California Natural Gasoline Association meeting.

Filtration

Some amount of iron sulfide, inerts and carbonaceous materials will usually collect in the amine system in spite of all normal precautions. The continuous circulation of these materials causes a considerable amount of erosion of pumps, tube bundles, and lines. Fouling of heat exchanger surfaces and plugging of valves, lines and columns are also serious problems resulting from insolubles.

There are a number of different filters being used and many of them are fabricated to meet individual needs. Most of these filters operate on a slip stream sized at 5 to 10 per cent of the amine-solution circulation rate.

It is probably unnecessary to go into a lengthly discussion of filtration at this point. For the sake of completeness, however, several remarks on this subject will be made.

Cotton waste, rag, canvas bag, and cotton twine are among the filter elements which are used successfully in removing medium to large-size particles. They have the advantage of high throughput with low pressure drop at nominal expense for labor and filter elements. Some manufacturers of the tightly wound twine-spool cartridges claim removal down to less than 100-micron particle size.

Diatomaceous earth and precoated canvas are somewhat more expensive but will remove down to very small particle size. In some cases, these are combined with one of the elements mentioned above to treat the slip stream with two filters in series. In other plants having solution-redistillation facilities, the fines are effectively removed during the redistillation so that only the more coarse filtration is needed.

For solutions where foaming problems are present, activated carbon or charcoal beds have been effective in removing the trace amount of suprface-active compounds causing the trouble. While the authors do not state that this treatment is a cure-all for foaming due to contamination by surface active compounds, it has been effective in each instance known to them. The treatment is certainly worth trying in cases of persistent foaming, since it is simple and relatively inexpensive.

The equipment is normally comprised of two activated-carbon beds. They are installed in series but piped so that they can be interchanged, and so that one or the other can be taken off stream. Flushing water and steam should be available to the beds. Their size should be such that each contains from about ½ to 1 lb. of activated charcoal per gallon of feed per minute.

After being placed on stream, they are operated for a month or so, the optimum time being determined by trial, after which the leading bed is pulled off the line, flushed with fresh water and steamed until the flushing and condensate streams are relatively clean.

The clean bed is then put back on stream behind the second bed, which then becomes the leading bed. This cycle is repeated as necessary. Vendors of the activated carbon will be helpful in establishing the cycle length and the bed size as well as the carbon reactivation techniques.

Big Barge in the Bayou Country. The drilling barge *Lewis Geer* is no stranger to the Louisiana swamplands. Owned by Golden Meadow Well Service Co., New Orleans, this self-contained rig has been drilling wells in the area since 1955. Here it is shown working on a deep one in the Little Bayou Pigeon, Iberia Parish.

With the hole at 11,500 ft, the crew ceased drilling so that a bottom-hole survey could be run. That neatly stacked pipe was pulled to the surface by the Bethlehem rotary line, a 1⅜-in. 6x19 rope with independent wire rope core. This was all in the day's work for the husky steel rope, which already had thousands of ton-miles to its credit and would log many more. For coring jobs, the barge was also well equipped, being rigged with a Bethanized (rust-resistant) coring line of 6x7 construction.

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For long lengths of piping

This formula tells right line size

BY FRANK LIPINSKI
Hydrocarbon Research, Inc.,
New York City

BY THE FORMULAS given by C. E. Lapple, Fig. 1 gives plots of P_3/P_o vs. G/G_{cnl} for N's not given in his original article. These data allow closer interpolation for pressure drops at relatively large equivalent lengths of piping. The data in Fig. 1 may be used for K values of 1.0 to 1.8 because of the negligible difference between the curves at the high value of N.

By Lapple's method a theoretical length, L′ can be determined that will consume all the pressure drop available, 1,000 − 14.7 = 985.3 psi. The last 2,000 ft. of this theoretical length of L′ will have the same fluid-flow phenomenon as the 2,500 ft. of the illustrative example in Part 1 of this series published April 14. Hence, the pressure at a point L′ − 2,500 ft. from the start of the theoretical line will be equal to P_B.

Using data given in Lapple's article, let us consider the actual calculations involved in determining P_B under the following conditions:

Temperature	800° F. = 1,260° R.
Molecular weight	18
Flow from relief valve, lb./hr.	60,000
Pipe diameter, i.d.	4.0
Density, lb./ft.^{3}	1.33
Viscosity, cp.	0.016
Velocity, U (upstream conditions), ft./sec.	144
K, C_P/C_v	1.4

$$N = 160 \text{ and } N = 4fL'/D_H$$

$$\text{Reynolds Number} = Re = DUP/M$$

$$G_{cnl} = 1{,}000 \times 144\,[(32 \times 18)/(2.718 \times 1{,}546 \times 1{,}260)]^{1/2}$$

$$G_{cnl} = 1{,}490$$

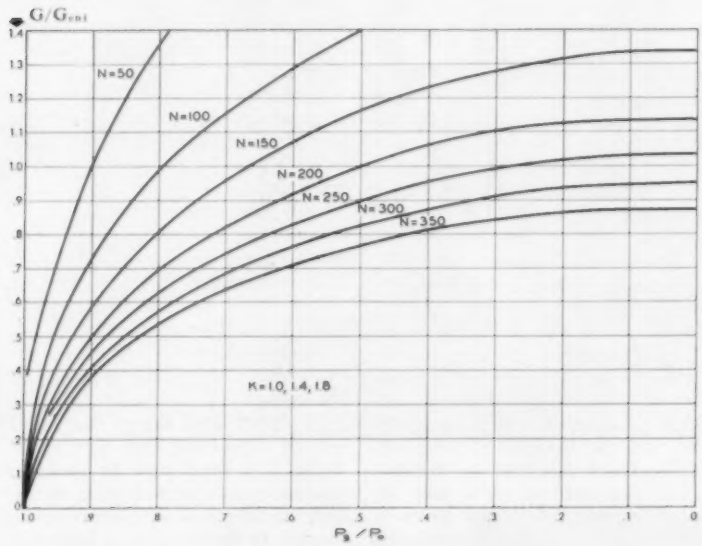
$$G = 60{,}000 \times (1/3{,}600) \times \frac{1}{0.785 \times (16/144)}$$

$$G = 192 \text{ lb./sec.-ft.}^2$$

$$G/G_{cnl} = 192/1{,}490 = 0.13$$

$$\frac{P_3}{P_B} = \frac{14.7}{1{,}000} \times \frac{144}{144} = 0.014$$

from plots of P_3/P_o (or P_3/P_B) vs. G/G_{cnl}.



THESE DATA may be used for K values of 1.0 to 1.8. Fig. 1.

$$= \frac{4}{12} \times \frac{144 \times 1.33}{0.016 \times 0.000672}$$

$$= 6 \times 10^6$$

from standard plots of Fanning friction factor, f, vs. Re:

$$f = 0.0032$$

$$\therefore N = 160 = 4fL'/D$$

$$\text{or } L' = \frac{160}{4 \times 0.0032 \times 4/12}$$

$$= 37{,}500 \text{ equivalent ft.}$$

$$L' = 37{,}500 \text{ ft.}$$

$$\text{At } L' - 2{,}500 \text{ or } 37{,}500 - 2{,}500 = 35{,}000 \text{ ft.}$$

$$N = 4 \times 0.0032 \times (4/12) \times 35{,}000 = 150$$

$$\text{At } N = 150 \text{ and } G/G_{cnl} = 0.13$$

$$P_B/P_o = 0.25$$

$$P_B = 0.25 \times 1{,}000 = \mathbf{250 \text{ psia.}}$$

Had the back pressure P_B calculated out to be higher than the critical pressure P_c, or say 550 psig. then the relief-valve outlet flanges would probably not withstand such a pressure and the line size should be increased. In cases where back pressures of higher than the critical can be tolerated, then the relief-valve orifice area must be sized by the proper formula.

Cutting-in problems

can be solved with the right spooling know-how and equipment

AS WELLS are dug to greater depths and industrial loads are heavier, line cutting in becomes an increasing problem.

This cutting in as referred to here is where the wraps of line which are being spooled on or off cut in between wraps on the preceding layer. Cutting in usually occurs when a heavy load is being lowered on a drum of wire rope that has been spooled up loosely.

Where smooth drum cores or helical spooling is used and line control cannot be maintained, line slipping sideways or gapping is more in evidence under the greater weight pressure applied to the line on the core.

Spooling control is of paramount importance when light hook load is speedily raised without enough load weight to cause the line to be spooled tight on the drum core before lowering a heavy load.

On drilling rigs when lowering an additional double, treble, or fourble of pipe into the hole, the weight of the long string of pipe is transferred to the line on the hoisting drum, which will start the line to slipping sideways and cutting in if it has not been spooled properly.

Regardless of how large or small the hoisting unit, it is almost impossible to get the traveling block, hook, and elevators too heavy.

Wire Line Care

Wire rope is one of the most expensive replacement items around a rig. It is precision-made with many moving parts; the lay, the helix of the strands, and many other engineering details are carefully worked out to give the longest life and the best performance.

Modern spooling, plus an effective maintenance program and a knowledge of the correct use of the various types of wire rope as prescribed by the manufacturers, will enable rig owners to obtain the optimum service life built into the wire rope.

Taken from LeBus-International Engineers, Inc., wire-line-spooling handbook.

Some of the reasons for wire rope failures during servicing or workover operations are discussed here with suggestions for proper use:

1. Make sure the proper type of construction of line is used on your particular type of equipment.

2. Order wire rope to proper length, diameter, construction, and grade. Specify socket to be attached by manufacturer.

3. Employ the most modern spooling method which utilizes the newest-type grooving on the hoisting drum for controlling and safeguarding wire rope.

4. Install rope properly from shipping reel to pulling-unit drum.

5. Observe initial break-in period carefully.

6. Inspect sheaves regularly for wear and proper alignment.

7. Prevent shock loading on wire line. This imposes a severe strain on the line, causing it in some cases to neck down. Strands become unbalanced, causing early retirement.

8. Lubricate periodically and particularly before a storage.

Spooling swabbing lines . . . When a swabbing line is to be installed on a machine, permanent damage can be done to the line if pulled around a corner or sill. This can, and often does, create a spiral condition throughout the length of the line.

Some operators put the line on the drum direct from the reel, drive the unit out of some side road, lay the line off along the bar pit, then reeve it on the drum using the weight of the line and the friction of the ground to get it tight on the drum. This is a satisfactory method, provided the road is long enough and there are no bridges or other obstacles which can foul up the line.

The best method is to take the line from the reel to the drum in the operator's yard, if possible. Installation from the shipping reel to the pulling-unit drum must be done with great care. The shipping reel should be jacked up so that the reel is free to rotate as the line is pulled off.

The reel should be so placed that the rope will not pull over any obstacle or obstruction. In some cases, a large block, such as a tubing block, may be profitably employed to keep the rope clear of obstacles.

Never use a small snatch block, such as if often carried on an oilfield truck, for this purpose. Extreme damage resulting in short rope service is inevitable. A brake attachment on the reel or a braking device on the reel base will provide enough tension to thread lay the line tightly on the drum. Braking is imperative to accomplish smooth and tight winding on the pulling-unit drum.

Another method of accomplishing this braking is to employ a manila rope as a brake band around the reel flange. Spikes are driven into the periphery of the flange to form guides to keep the manila-rope brake in contact with the flange. The manila rope must be anchored to a stationary object to provide tension sufficient to impede the rotation of the shipping reel and afford smooth and tight spooling on the pulling unit drum.

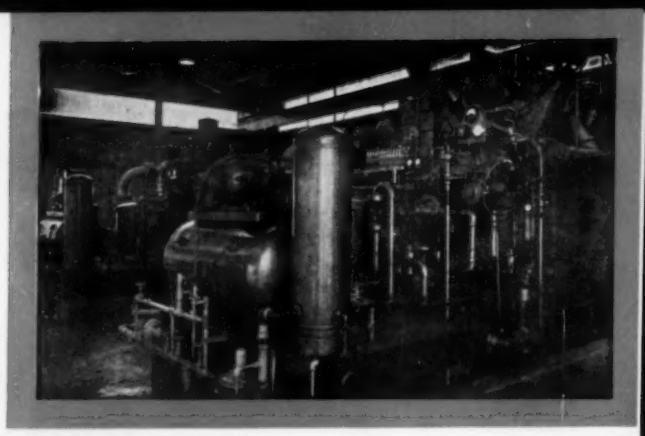
The practice of turning a reel over on its side then pulling the line onto the drum can be harmful. The longer the line, the more weight is involved, resulting in abnormal strain.

Where any type of line is used with a divider, the crossover point from the surplus rope to the hoisting drum is another potential trouble spot. This sharp breakover will weaken the line and can cause core popping and bird caging.

If there is an insufficient amount of rope on the hoisting drum, the line at the crossover will pull down into the inner layers, causing crushed spots and dog legs.

Rod and tubing lines of 18 x 7 nonspinning construction require a break-in period under light load. This is necessary to allow the wires in the strands and the strands in the rope to position themselves and relieve any differential tensions that may have been picked up during installation.

A heavy pull during the initial service life of the line, such as will occur if a stuck pipe or packer is encountered, may well keep the line from turning in a satisfactory service record. In the event of a sudden release of tension, pump or packer broken free, a new line may be destroyed immediately.



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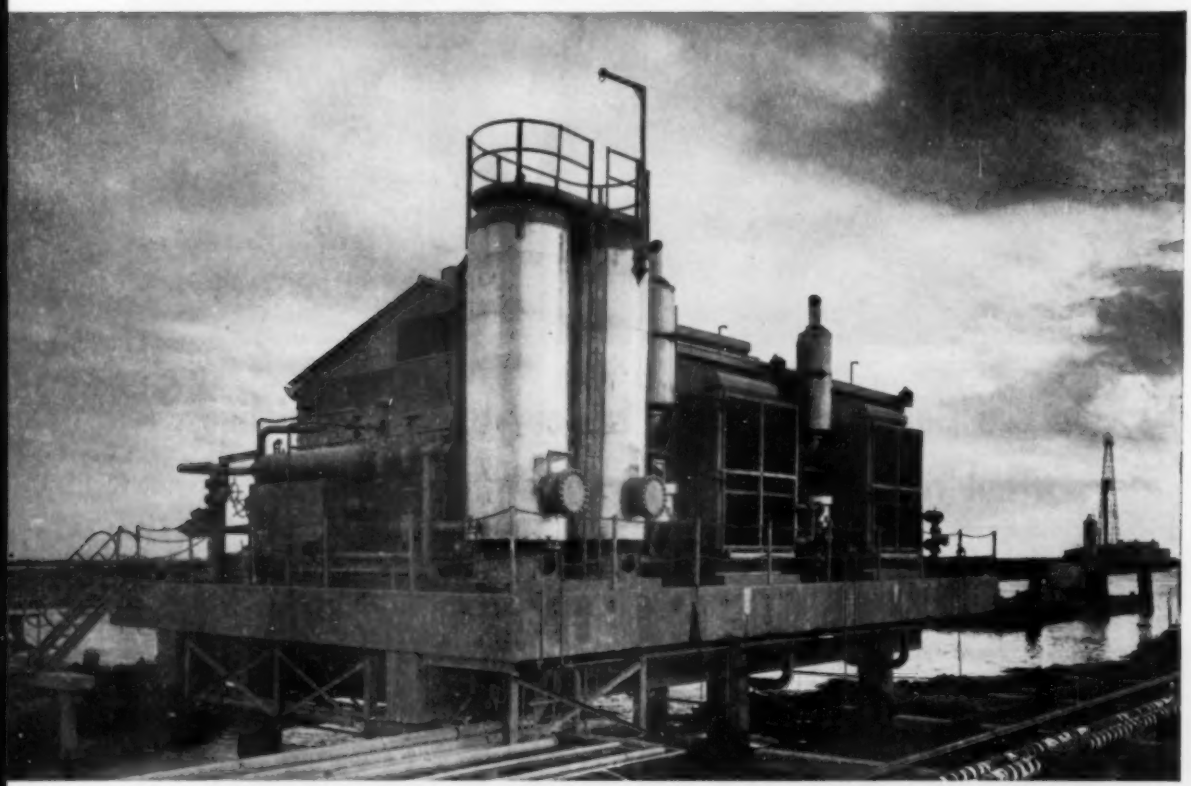

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On the Job

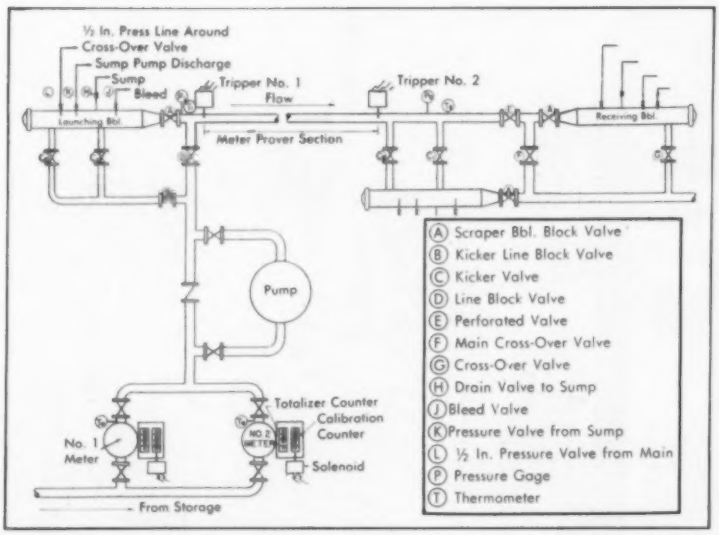
PIPELINING

METER PROVING
PART 5 (Conclusion)

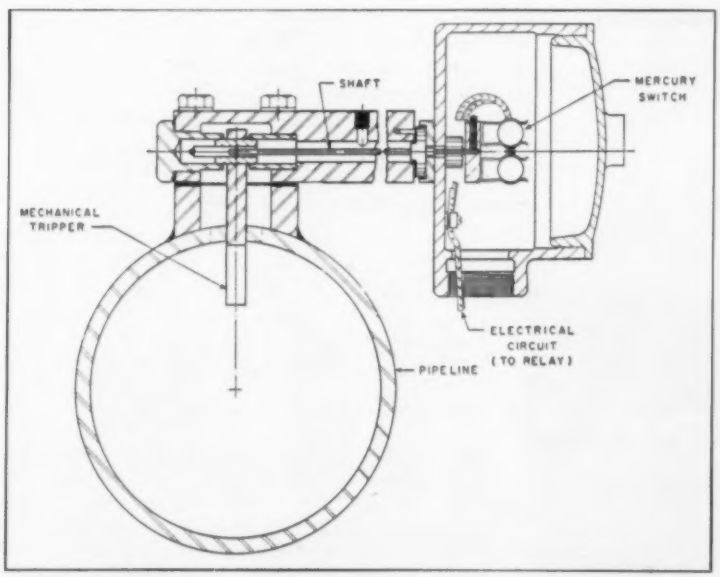
Careful attention must be given to size and design when

Constructing meter provers

BY M. L. BARRETT, JR.
Shell Oil Co.



SCHEMATIC of meter-prover-section installation at origin of a pipeline. Fig. 1.



ONE TYPE of pipeline-scraper indicator (tripper). Fig. 2.

FIG. 1 is a schematic diagram of a meter-prover section installed on the downstream side of several meters showing the relative position of the meters, pump, scraper-launching barrel, meter-prover section, and scraper-receiving barrel.

It is felt that a workable size for the meter-proving section would be about one-tenth of the normal flow in barrels per hour through the meter or meters to be proved, but in no case should its capacity be less than 10,000 times the least reading of the meter register in order to enable determination of registered quantities to within 0.01%.

It is considered essential in the construction of a pipeline prover section to eliminate excessive bends or any features which might disrupt the uniform passage of a scraper, an internal lineup clamp, equipped with a tight-fitting copper cylindrical shoe, is used at pipe welds to prevent the formation of welding icicles.

An electrical switch is one type of mechanical tripper which can be employed at the extremities of the meter-prover section to determine the instant a scraper passes through the line at that point.

Fig. 2 is a schematic of the electromechanical tripper. As the piston or scraper passes through the line it strikes the arm extending into the line and through a torque-tube arrangement is able to actuate the electrical switch.

A suitable type piston or scraper for meter-proving purposes by this method consists simply of a stiff steel shaft to each end of which is attached slightly oversized pump cups or disk-type scraper rubbers. The disk-type rubbers are preferred for economy sake for they can be trimmed down when they are worn out and used in pipes of smaller diameter.

Each meter in the group of meters being proved is equipped with a register comprising two counters shown in the schematic diagram of Fig. 3.

The totalizer counter runs continuously to record the accumulative flow through the meter while the proving or calibration counter is automatically engaged by Tripper 1 (Fig. 1) through solenoid actuation and automatically disengaged by Tripper 2 when the solenoid is deenergized.

A meter register and its solenoid-actuating system can be modified and installed on a Brodie meter. A pilot light is incorporated in the solenoid circuit to provide a visual indication of the presence of a

Paper presented at ASME petroleum division annnual conference, Tulsa.

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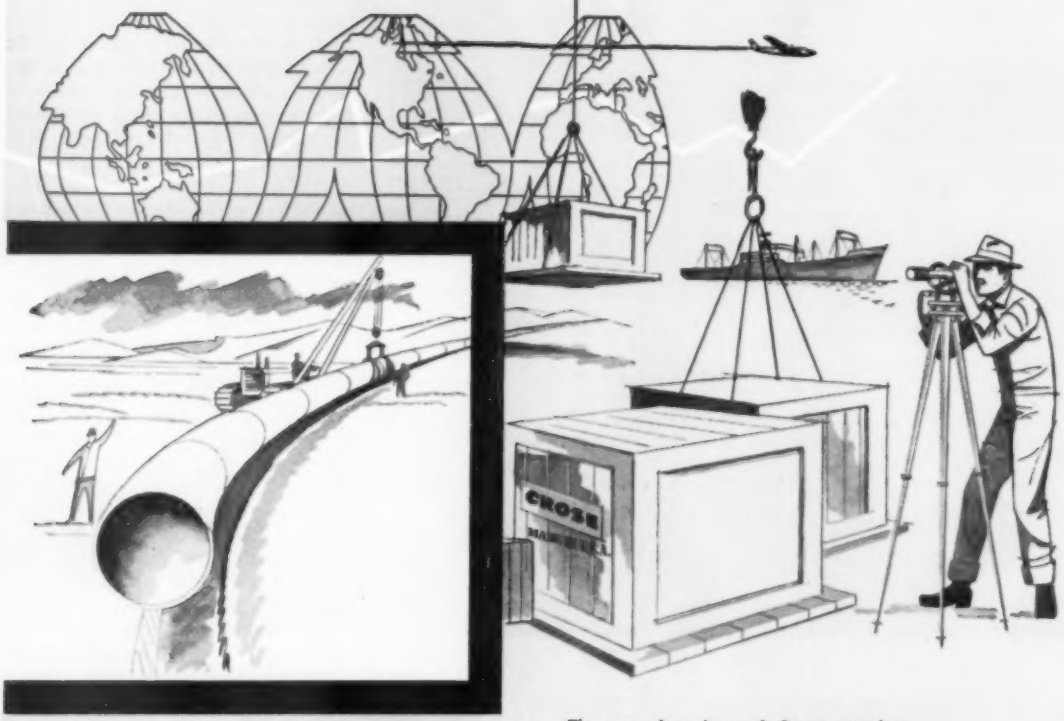

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scraper in the pipeline meter-prover section.

For a pipeline prover section, Tripper 1 consists of a normally open electrical switch while Tripper 2 consists of a normally closed electrical switch.

As the scraper passes Tripper 1 its switch is closed, the solenoids are energized and the meter-proving counters begin their registration. This continues until the scraper passes Tripper 2, whereupon its normally closed switch is opened, the solenoid deenergized and the meter-proving counters caused to stop.

The determination of the displaced volume of a meter-prover section is a precision calibration job and should only be undertaken by competent personnel. Mathematical calculation of the volume of the section is not sufficiently accurate.

Fig. 4 is a schematic diagram of the installation of a meter-prover section on the upstream side of meters and their strainers. To calibrate this section, the skid-mounted portable master-meter unit is connected in series with the meter-prover section.

Each meter on this unit is equipped with both a totalizing and solenoid-actuated proving counter.

With the same stream passing the master meters and the meter-prover section, a standard scraper is shot through the section and the registration thereby accumulated on the solenoid counters of the master meters, corrected for meter factor, rate of flow, temperature, and pressure, is the net capacity of the meter-prover section.

Because the same type of scraper is used for prover calibration and meter testing, any alleged slippage across the scraper automatically is washed out, and will not influence meter accuracies. Additionally, if there is electromechanical drag or lag at the start of a meter-prover section there will be an equal lag at the end of the section and any effect therefrom has been determined to be insignificant.

In practical, everyday operation the meters involved are proved by simply launching a scraper from the launching barrel of Fig. 4 and allowing it to be received in the receiving barrel. The base volume of the meter-prover section is adjusted on the basis of the average of the pressures and temperatures at Trippers 1 and 2 and this adjusted volume compared to the total registration appearing on the proving counters of the meters.

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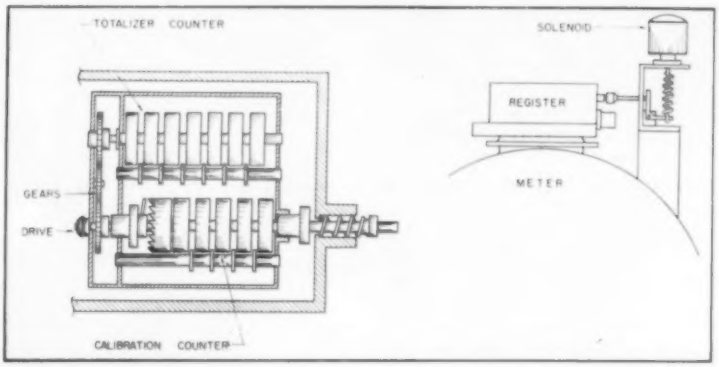

SOLENOID-ACTUATED modified meter register and clutching mechanism. Fig. 3.

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While the initial cost of a remote scraper station and the necessity of operating personnel handling and maintaining scrapers may be considered disadvantageous in this system, there are advantages which make it highly usable in many meter-proving situations.

1. Meter tests are accomplished without diverting, disturbing, surging, or slowing down of the normal stream flow.

2. The test run is completely automatic after dispatch of the scraper, so that a high degree of operating technique is not required to obtain an accurate proof.

3. The system is an entirely closed one providing complete vaporization control, eliminating the venting of hazardous vapors, assuring safety and accuracy in the test operation.

4. The flow rate at which meters can be tested is unlimited.

5. Reproducibility of test results with the method is excellent and can be considered to be 0.02 to 0.03%.

Conclusion

In the choice of a meter-proving system for positive-displacement meters, the user may choose either the gravimetric or the volumetric - type prover and within each category he may employ either the open or closed type depending upon the necessity of preventing vaporization of the test liquid.

Consideration should be given to the "running" versus "standing" start-and-stop proof. Most provers described herein can be built in sizes and shapes other than those presented.

Generally speaking, the number of meters involved in an installation, the maximum expected flow rate, the physical properties of the test liquid, the extent to which vaporization must be controlled, the first cost and the operating cost, along with the desired speed and accuracy of proof are items which must be given thorough consideration in the design of a meter - prover system. **End.**

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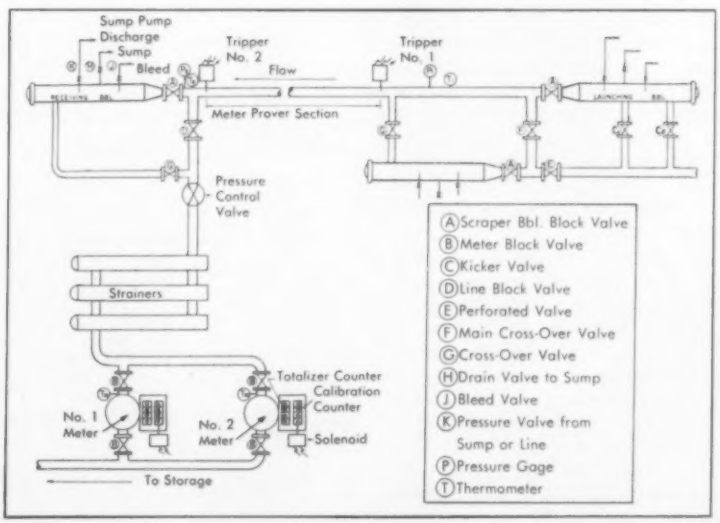

SCHEMATIC of meter-prover-section installation at terminus of a pipeline. Fig. 4.

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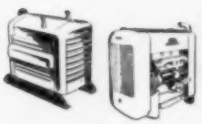

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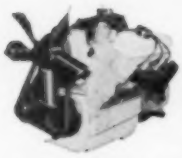

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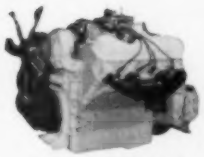

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The well was drilled to 12,600 ft. and completed in a 11,600-ft. sand in an over-all time, on and off location, of 38 days. The next previous well, a joint operation drilled with another rig for Mississippi River Fuel Corp., its parent company, and The California Co., took 54 days with hole carried to 13,725 ft.

Two earlier wells which the company drilled for its own account required 71 and 53 days, respectively, from start to finish. They were drilled to depths of 12,415 ft. and 12,323 ft., respectively.

The new inland-water drilling barge, the Ray Terry, is the company's first diesel-electric assembly. It is designed for drilling depths of more than 20,000 ft., and has an Ideco E-2500 draw works powered by a General Electric drive system which develops more than 2,500 hp. Prime mover consists of four diesel engines.

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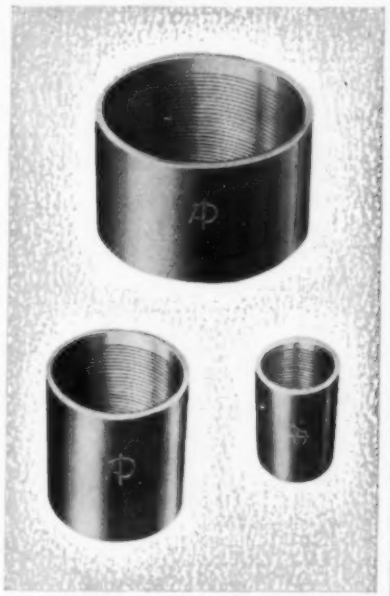
The barge is named for R. V. Terry, vice president and general manager of the company.



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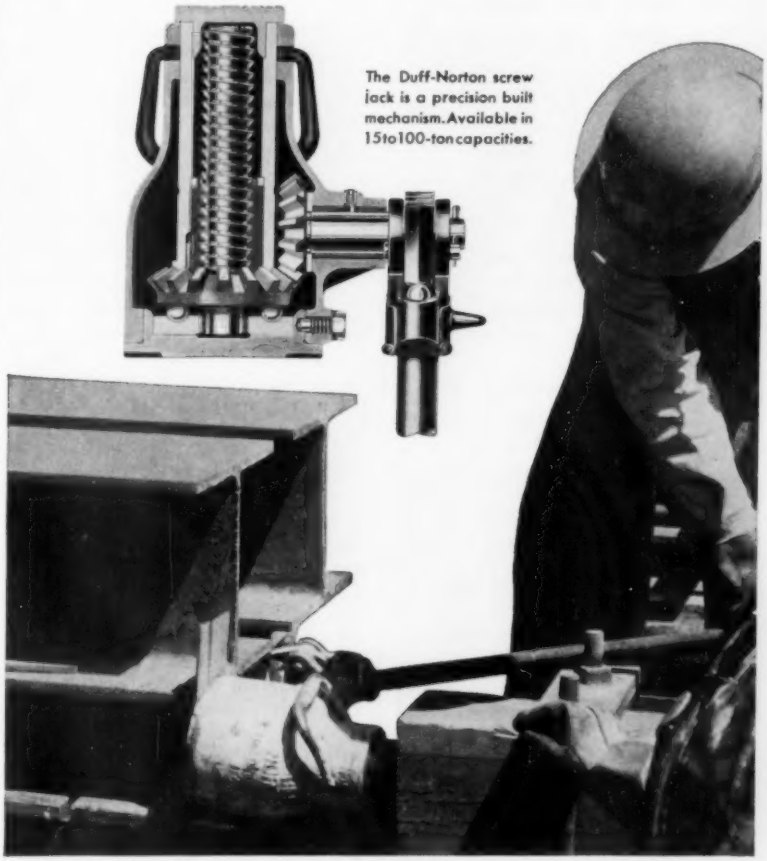

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Who's getting the drilling contracts

Brewster-Bartle Drilling Co., Houston, has the contract on the second well Union Oil Co. of California has scheduled for its prospective new field about 4 miles north of Fresh Water Bayou field, in the coastal marshes of Vermilion Parish, Louisiana. Its location is about 2,000 ft. east of Union's indicated discovery well, drilled by **Stewart & Granger Drilling Co.,** of San Antonio. The latter well, drilled to 14,570 ft., is testing sands below 13,300 ft. Brewster-Bartle's operation is projected to 13,850 ft. Both wells are on Union's Louisiana Furs lease.

Stice Drilling Co., Beeville, Tex., is getting started on Benedum-Trees Oil Co.'s second well in the new Delate Charco field, 13 miles west of Falfurrias, in northwestern Brooks County. Location is for 2 Felix de Barrera. Contract depth is 6,100 ft.

Holmes Drilling Co., Houston, has a contract with Michel T. Halbouty, Houston independent operator, for a deep wildcat test to be drilled in the southwestern corner of Liberty County, Texas Gulf Coast. Its location, at 1-E Kirby, is about 4 miles northwest of Mount Belvieu, and about midway between Barbers Hill field, 2 miles south in northwestern Chambers County, and Esperson field, on the north. Halbouty has a permit for a 12,000-ft. test.

Golden Meadow Well Service Co. is keeping a rig under contract to Reece E. Carter and K. A. Meredith in the Unknown Pass area, in Lake Catherine between Lake Pontchartrain and Lake Borgne, in eastern Orleans Parish, southeastern Louisiana. The rig has just completed one well for the above operators, and now will drill their second. The first, drilled to 5,500 ft., has been completed as a gas-discovery well in pay at 5,436-40 ft. The second, located west of the first, is projected to 10,000 ft. Both locations are in Lake Catherine.

General Petroleums of Canada, Ltd., Calgary, has contracted for the second wildcat test Canadian Oil Companies, Ltd., and Colorado Oil & Gas, Ltd., propose to drill in the Steelman Consolidated area, 6 miles southwest of Frobisher, in southeastern Saskatchewan Province. The new location, 7-1 White Rose-Colorado-Paramount-Hirsch, is about a mile from the above operator's first test, abandoned earlier this year. It was drilled to 5,200 ft.

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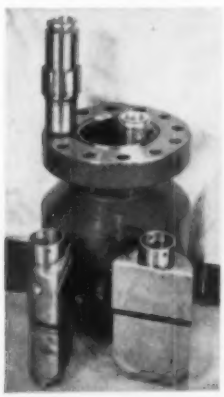
In operation the internal valve of the dampener air-pressure chamber opens with the aid of a tension spring when pump pressure balances and exceeds air pressure, and thus exposes the air chamber to the working fluid. **Write or call: National Supply Co., Two Gateway Center, Pittsburgh 30, for details on pulsation dampener.**

●



Dual-tubing hanger

. . . eliminates need for sleeve valves. Designated U-65, the dual-tubing hanger allows both strings of tubing to be raised simultaneously at completion or to later kill the well, but with complete control at all times, the maker reports. Used as a component part of an OCT universal tubing head, the hanger allows the well to be completed with the christmas tree in place. And the well may be killed through the tree. All major flanged connections may be tested in the field.

The head is made in a complete range of sizes with working pressures from 2,000 to 10,000 psi. **Write or call: Oil Center Tool Co., 1912 Airline Drive, Houston 9, for details on dual-tubing hanger.**

Floater hose for offshore use . . .

. . . makes tanker loading, unloading easier. The new offshore floater-hose assembly was designed to save time, prevent losses through replacement of hose, and help prevent accidents in the transfer of oil and fuel at offshore drilling installations as well as ship to shore.

The complete floater-hose assembly is made up of three different, but complimentary, components. The first component is a 250-ft., continuous length of discharge hose. It is constructed of synthetic compounds and reinforced with nylon tire cord.

The second component is a reel. It houses the discharge hose. A coating protects the reel from salt air and abrasion.

Steel rollers are furnished to be placed in front of the reel. They prevent the hose from scuffing against the dock. The third component is the pontoon. It is a rectangular rubber balloon that measures 19 ft. 4 in. long when inflated with air. **Write or call: Quaker Rubber Div., H. K. Porter Co., Tacony and Comly Streets, Philadelphia 24, for details on offshore floater hose.**

Send this **Showcase Coupon**

to the **Manufacturer** of the item in which you are interested. See name, address, and equipment name and/or model, in bold-face type at end of description.

NAME AND/OR MODEL NUMBER.....

.....

.....

Described in OIL AND GAS JOURNAL - Issue of May 5 1958

NAME.....TITLE.....

COMPANY.....

ADDRESS.....

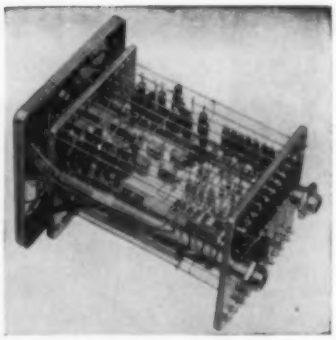
CITY.....STATE.....

DATE.....

Automatic oil production

. . . system gathers, stores, and relays data. The new system of integrated production - automation equipment gives: (1) instant knowledge of all operational data on volumes, pressures, levels, temperatures, and b.s. and w. for any point in the field, (2) central control of all equipment on the system, and (3) failure warnings for all field equipment.

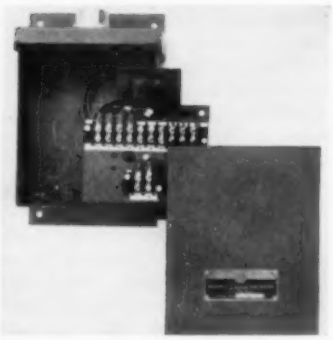
Heart of the information-gathering phase is in two Monitron transistor units centrally located in the field. One gathers and stores data in coded form. The second relays the data to



the central office at any predetermined interval, or on demand, via any existing communications system — telephone, carrier radio, VHF, or microwave.

Installation is custom designed to the producer's needs. It can include any one or all three of the monitoring, central-control, and warning phases. **Write or call: Odex Engineering Co., 1410 North Grant, P. O. Box 1586, Odessa, Tex., for details on production-automation equipment.**

●

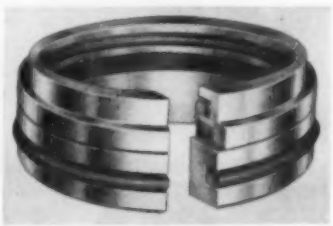


Transformer relay

. . . allows radio control of motors when used with safety switch. Called the Step-Saver, the transformer-relay assembly measures 6¼ by 8 by 3 in. When used with the proper Murphy safety switch, it can stop, start, or reverse an electric motor by radio control, or upon a change in time, tank level, line pressure, or temperature.

It controls up to 440 volts with a safe, 24-volt, grounded circuit. It can sound and flash alarms when things go wrong and immediately shut down equipment before damage occurs, the maker says. **Write or call: Frank W. Murphy Mfg., Inc., Ranch Acres Station, Tulsa, for Bulletin TR-1.**

●



Mechanical seal

. . . uses magnetic force for even pressure on seal faces. Only two working parts make up the seal. The magnetic force retains an even pressure on the optically flat sealing surfaces, regardless of the operational pressures, the maker claims.

A seal is formed between self-lubricating carbon and Alnico metal-lapped faces. The maker claims the magnetic

(Continued on page 147)

METAL TRANSFERS HEAT MORE THAN 50,000% BETTER THAN AIR!

In mechanical bond finned tubes an air gap is always present between the fin and the tube which greatly reduces efficiency. Heat expansion loosens this bond and creates an even larger air gap which further retards heat transfer.

Air gaps are avoided in Smithco Air Cooled Heat Exchangers by employing metal as the bonding agent. This metal bond provides a smooth, unbroken flow of heat from tube to fin. Smithco *Metalbond* also provides against corrosion and has proven to be the most permanent bond yet devised.

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Engineering Inc.

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TULSA, OKLAHOMA

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LIBERTY PUMPING UNITS

There is no finer oil well pumping equipment made than TEXASTEEL SUCKER RODS and LIBERTY PUMPING UNITS. LIBERTY equipment has been proven in field operation since 1918. But the only way *you* can know the performance of this equipment is to *prove it to yourself.*

TEXASTEEL SUCKER RODS and LIBERTY PUMPING UNITS are available from twenty strategically located field warehouse stocks* to insure prompt delivery to your well site. They are sold through supply stores only.

Descriptive technical literature and price sheets are available on all LIBERTY products. Please contact your LIBERTY Sales Representative or local supply store.

*ARKANSAS: Magnolia. COLORADO: Sterling. KANSAS: Great Bend. LOUISIANA: Shreveport. MISSISSIPPI: Laurel, Natchez. NEBRASKA: Kimball. NEW MEXICO: Farmington. OKLAHOMA: Duncan, Oklahoma City. TEXAS: Abilene, Alice, Albany, Borger, Wichita Falls, Kilgore, Houston, Pampa, Odessa. WYOMING: Casper

TEXASTEEL SUCKER RODS and LIBERTY PUMPING UNITS

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MANUFACTURING COMPANY

4025 Hemphill Street • Fort Worth, Texas

Here comes a good bit
REED
"Y" SERIES
ROCK BITS

. . . . . and here's why

Reed Three Cone "Y" Bits are the latest development in Reed's thirty-seven year history of designing and producing rock bits. The Reed "Y" Bit that is making hole for you today is the result of hundreds of thousands of man hours of research, engineering and technical effort spent by Reed Research and Engineering.

Reed research facilities are located in two large buildings at the Houston plant. They include complete metallurgical and chemical laboratories, mechanical testing apparatus, experimental heat treating facilities and an experimental machine shop. Laboratory drilling rigs that can apply loads of 100,000 lbs., at rotating speeds up to 500 rpm, with pump pressures to 5,000 psi, test full size bits on rock samples from all over the world.

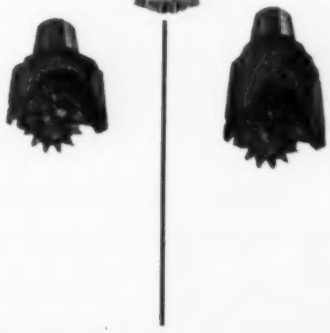
Metallurgists, chemists, designers, engineers work as a team to develop a product that is produced to precise standards by skilled technicians in Reed's manufacturing plant. The compound benefit of *know-how* in design, development and manufacturing is a rock bit that is uniform in quality, bit after bit after bit.

Proved in the field for four years, the Reed "Y" Bit is the bit that will *dig*. You can't run a better bit.

REED ROLLER BIT COMPANY • Houston 1, Texas

GULF COAST, MID-CONTINENT, ROCKY MOUNTAIN AND CANADIAN DISTRIBUTOR FOR MARTIN-DECKER PRODUCTS

REED Y BITS



NEW INTERNATIONAL®
330 UTILITY TRACTOR

NOW! MORE 'BEEF'

than ever before in a 35 hp rig!

It's terrific for trenching, loading, 'dozing! Now you can get an International tractor in the economical 35 hp class, with strength and stamina for high capacity and low maintenance. The new International 330 Utility has up to 900 pounds greater built-in weight than other tractors of similar horsepower—really *rugged* construction! Handle 1,000 pounds with a front-end loader, lift 4,000 pounds with rear-mounted fork, dig faster with heavy-duty backhoe.

ALL the work-easing features of larger IH tractors are available—10 speeds forward with Torque Amplifier drive . . . power steering . . . job-tailored Hydra-Touch equipment control . . . Fast-Hitch.

See how heavy-duty design can cut your costs! Look in the classified directory . . . phone your IH Dealer. For free catalog, write International Harvester Co., Dept. OGJ-5, P. O. Box 7333, Chicago 80, Ill.

SEE YOUR
INTERNATIONAL HARVESTER DEALER

International Harvester Products *pay for themselves in use*— Farm Tractors and Equipment . . . Twine . . . Commercial Wheel Tractors . . . Motor Trucks . . . Construction Equipment—General Office, Chicago 1, Illinois

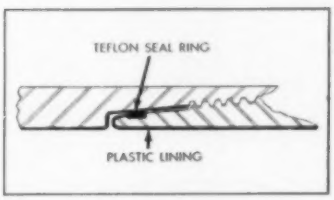
International tractors with matched loaders and backhoes are now available as complete units—backed by unexcelled IH facilities for parts, service, and financing. Above, the new International 330 Utility tractor equipped with International Wagner backhoe and loader. Below, the 330 Utility with International Pippin units.

For extra-rugged service, ask your IH dealer to show you the husky, 45-hp International 350 Utility . . . Over 5,500 lb drawbar pull. Below, ½-cu yd rear-mounted rotary scoop.

method of eliminating springs eliminates mechanical breakdown.

The magnetic seal can replace conventional packing or spring-loaded mechanical seals in pumps, compressors, or on any rotary shaft where liquids, gases, or corrosives are to be sealed. It fits any stuffing box and is easily installed. **Write or call: A. W. Chesterton Co., 6 Ashland Street, Everett 49, Mass., for details on mechanical seal.**

●



Tubing joint is plastic-lined

. . . to threads, around nose, under ring.

The slight modification in the design of the HGT super-slim integral tubing joint was done so the efficiency of plastic-lined tubing is maintained. The box end of the tubing joint is plastic-lined to the threads. The pin end is plastic-lined around the nose and under the Teflon ring which gives complete coverage.

The tubing connection was developed to give: (1) joint strength over 100%; (2) high torque capacity; (3) flush-bore tubing joints to provide streamlined flow; (4) small o.d. for clearance; and (5) no counterbores or sharp or square corners to create stress-concentration points. **Write or call: Hardy-Griffin Engineering Corp., 14522 South Main Street, Houston, for details on tubing joint.**

●

Plywood-molded pipe

. . . is easy to handle and install. And it is long lasting, according to the maker. The new plywood-molded pipe can be produced in any diameter and lined with any type of material to fit the requirements of any job.

It offers advantages over pipes of conventional materials. It's specially treated for long life. Too, it is light and easy to ship, handle, and install. The plywood pipe is also easily adapted to any job as it can quickly be cut to specifications.

Laminated wood veneers are bonded together to form the strong yet lightweight tubing. **Write or call: Plycraft, Inc., Lawrence, Mass., for details on plywood-molded pipe.**

●

Union insulation rings

. . . are locked in to prevent their loss during makeup. The new insulated union with the insulation locked in place can prevent wasted time looking for lost insulation rings. The WECO

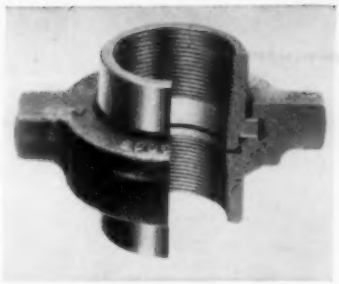
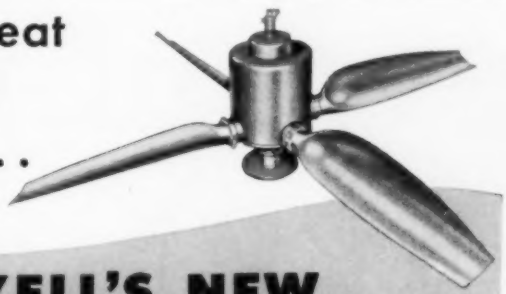


Fig. 211 insulated union is for use on installations that need electrolytic protection.

Though the laminated insulating

for peak heat exchanger efficiency . . .



HARTZELL'S NEW CONTROLLABLE PITCH FAN

The Hartzell Controllable Pitch Fan meets a long-standing need in the petroleum industry for a precise method of controlling a variable flow of air to maintain predetermined temperatures. On test installations, these new fans have proved their ability to hold outlet temperature fluctuation to plus or minus 1½°F. And, while achieving this highly accurate level of control, they consume up to 50% less power than required by conventional fixed-pitch fans.

In a temperature sensitive control system depending on air flow, the amount of air required to achieve the necessary cooling depends on the temperature of the air. High air temperatures require high air deliveries, low air temperatures require minimum air deliveries. With a Hartzell Controllable Pitch Fan, variable air delivery is accomplished by variation in blade pitch setting. The fan assembly responds instantly and automatically to conventional temperature sensitive control equipment — increasing blade pitch to deliver more air when outlet temperature rises, decreasing blade pitch and delivering less air when outlet temperature falls.

For complete details on Hartzell's controllable pitch heat exchanger fan, write for Bulletin 111-B or call your nearby Hartzell field engineer.

HARTZELL PROPELLER FAN CO.
Division of Castle Hills Corp.
72 Thomas Blvd. Piqua, Ohio

rings are securely held on the union, they can be easily replaced when necessary.

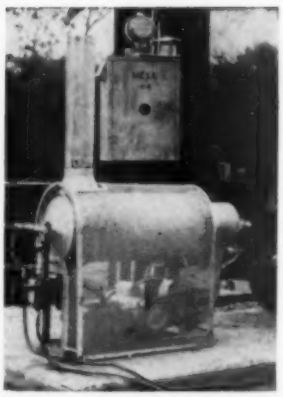
Over 35 million ohms resistance across the connection is provided by the union, the maker reports. A tight seal is obtained under all conditions of surge and vibration.

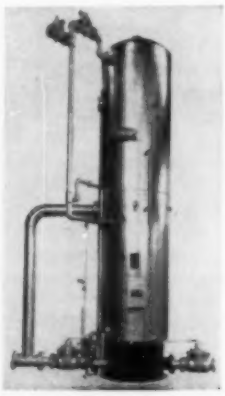
Both the insulation rings and sealing rings give protection up to 350° F. The union comes in sizes of 1 through 4 in. for pressures up to 2,000 psi. **Write or call: Well Equipment Mfg. Corp., P. O. Box 2593, Houston, for details on insulated union.**

Bottom-hole heater

. . . warms reservoir to up production, lowers oil viscosity. A lightweight, high thermal efficiency, and application flexibility are features cited for this new Texsteam bottom-hole thermal unit (BTU). The total unit weighs only 157 lb. Its thermal efficiency approaches 80%, the maker claims. The heater is capable of raising surface temperatures to above 450° F.

Field applications include: (1) increasing reservoir temperatures near the well bore, (2) lowering viscosity, (3) removal of an asphalt-paraffin block at the sand face, (4) elimination of freezing in gas wells, (5) heating fluids for low-volume hot-water floods, (6) flow-line treating, and (7) high-temperature stock-tank or gun-barrel recycling. **Write or call: Texsteam Corp., P. O. Box 9127, Houston, for details on bottom-hole thermal unit.**





Metering separator

. . . for foaming crude will handle 50,000 bbl. per day. The unit dump volume of oil in the CHX metering separator is controlled by a hydrostatic-head, liquid-level controller. Thus the unit will dump the same amount of net stock-tank oil each cycle, regardless of the foaminess of the oil, according to the maker.

The external pressure-equalizing line can be furnished with valving that will maintain a lower pressure on the lower metering compartment than that on the upper separating compartment. This allows handling of large volumes of heavy, viscous oil.

The unit is available in sizes from 1 to 30 bbl. per dump. It will handle from 0 to 50,000 bbl. per day. The metering separator is furnished with a float-operated liquid-level indicator. And it is arranged so it can be converted to a float-operated volume-type metering unit. **Write or call: Oil Metering & Processing Equipment Corp., P. O. Box 10277, Houston, for details on metering separator.**

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Carbon steel—bars, structurals, plates, sheets, tubing, etc.
Stainless—pipe, tubing, sheets, plates, bars, etc.
Alloys—pretested, heat-identified alloys . . . case-hardening, direct-hardening, and heat-treated, including Rycut® free-machining leaded alloys.
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Services—fast, accurate processing—sawing, shearing, slitting and flame-cutting . . . any shape, any size, any quantity.

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Other products include: safety plate • grating • expanded metal • chain • wire rope • reinforcing bars • pipe and tubing metalworking machinery

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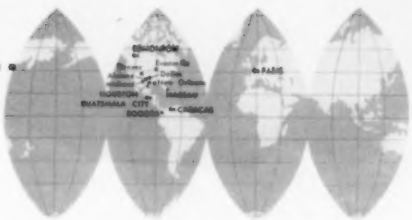
No matter where your oil prospects may be . . .

chances are General Geophysical Company has experience in the area (but not on the moon, *yet*). General's experienced crews and their modern field equipment have headquarters in seven division offices, and are accessible to nearly every oil area on the globe. This broad geographical coverage means faster, better coordinated geophysical service for you. And, regardless of where they are located, the services performed by General Geophysical crews set the standards of the exploration field.



General's division headquarters (▲) and supervisory field offices (●) are located in or near most of the free world's oil active areas.

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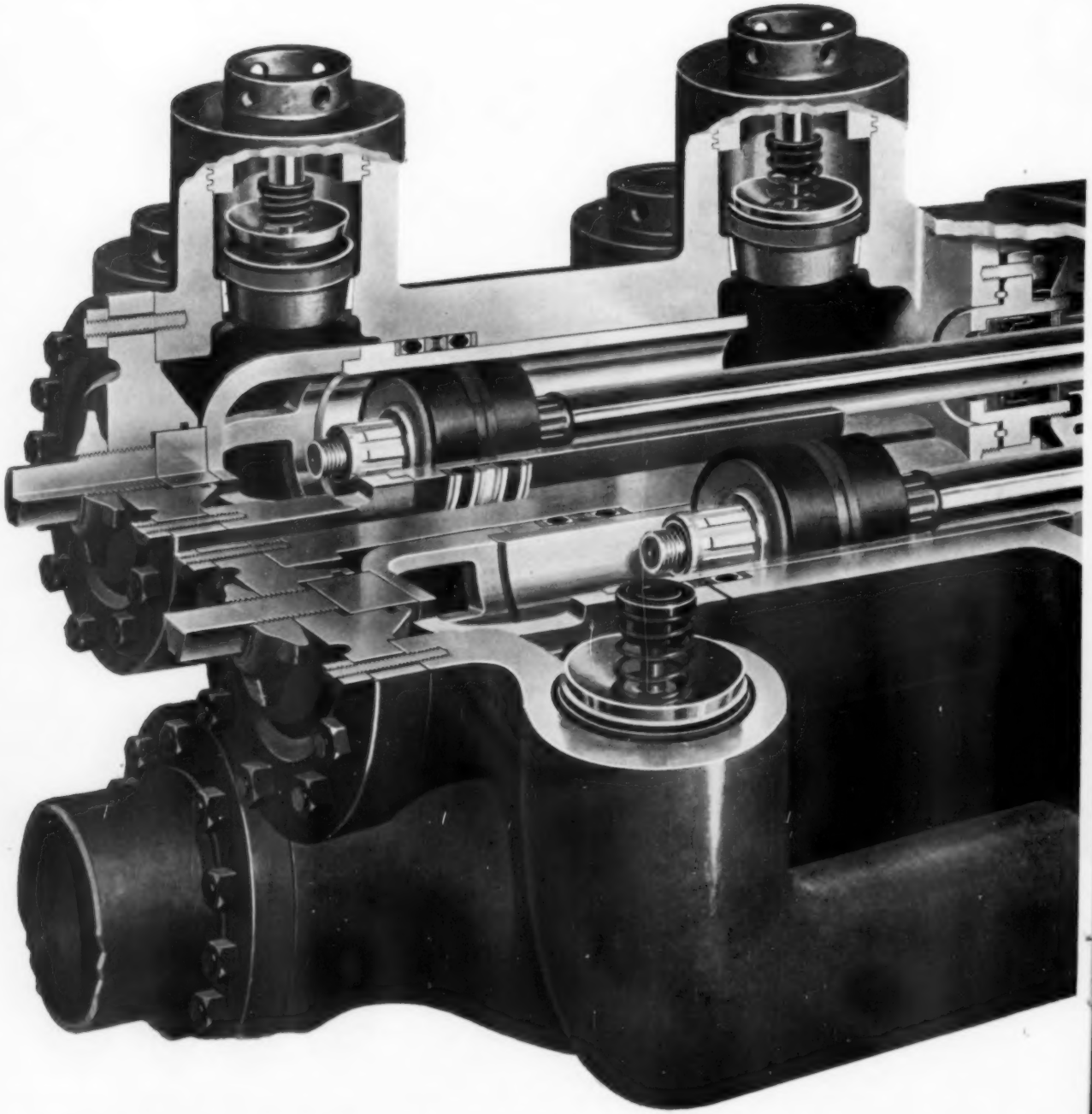
WHEN YOUR CONTRACT IS WITH GENERAL, THE PERCENTAGE FOR SUCCESSFUL EXPLORATION IS IN YOUR FAVOR

The "Inside Story" of the Heart



Since fluid-end pump parts must be correctly maintained for longest service, Mission has prepared a special Pump Maintenance Manual for your benefit. Write for your copy today!

SLUSH PUMP VALVES • PISTONS • LINER PACKING • LINERS • PISTON RODS • VALVE SPRINGS • GLAND PACKINGS • SLIPS • SWABS • PLUG VALVES • CENTRIFUGAL PUMPS

# of Your Rig ..... by MISSION

Copyright, 1958, Mission Manufacturing Company, Houston, Texas

WE MADE THIS cutaway view of a mud pump so you can see just where the vital fluid-end parts fit and why they are essential to correct operation. Your mud pump is one of the hardest working parts of your rig. Forces on these fluid-end parts are staggering. For example, pistons and rods may be subjected to forces of more than 100,000 pounds. These forces may be multiplied by shock loading at times, and they are completely reversed at least once every second. When you remember that mud may contain abrasive sand to cut metal parts, corrosive chemicals to pit them, and oil to attack rubber, it seems obvious that only the best pump parts stand a chance.

LIKEWISE, MISSION MUD PUMP VALVES AND SEATS may withstand pressures ranging from a near vacuum to well over 3,000 psi. In addition to other severe conditions, valves are required to seal perfectly even though mud may be loaded with all types of lost circulation materials.

In this service, only parts of advanced design and materials can stand up. That's why Mission has been a leader in pump parts research for many years.

But, most important, Mission pump parts are built to be used together to give even longer service. Here are some concrete examples.

MISSION PISTONS AND MISSION LINERS work together. Each depends on the other for trouble-free operation.

Both liner and pump bore depend upon the liner packing for freedom from fluid cutting. *MISSION SUPER-SERVICE® LINER PACKING* features exclusive "zero clearance" confinement of packing rings that multiply packing life many times.

Furthermore, accurate machining of the liner outside diameter of Mission Liners means longer life for packing.

Now consider the connection between Piston and Rod. Each depends on accurate taper, precise alignment and correct surface finish of the other. Our gaging procedures are designed and maintained to insure the required accuracy for positive interchangeability of both piston and piston rod tapers.

PISTON RODS AND GLAND PACKING depend on each other for satisfactory service. From an economic standpoint, *MISSION SUPER-CHROME PISTON RODS* and *MISSION SELF-SEALING GLAND PACKING* make an unbeatable combination. The pressure-seal feature of the packing extends rod life while the non-pitting chrome surface of the rods extend packing life.

Now look at Valve Seats. The correct size, taper and surface finish of the seat can prevent costly pump deck washouts. Mission employs some of the most modern manufacturing and quality control techniques to assure perfect tapers.

When you consider that these Mission Pump Parts are in direct working contact with the drilling fluid, it is easy to see that they are vital to correct pump operation. When you remember that they work together for trouble-free service, it makes sense to specify all Mission pump parts—exclusively—in all your pumps. Your pumps will perform better, require fewer repairs and cost less to maintain when you do. The famous Mission Guarantee assures you of this service.

Nothing but the finest will bear the name of MISSION MANUFACTURING CO.

MISSION MANUFACTURING CO., P. O. Box 4209, Houston, Texas • Cable Address—"Missco" • Export Office: 30 Rockefeller Plaza, New York
In The United Kingdom: MISSION MANUFACTURING CO., LTD., 17 Hanover Square, London, W. 1 England • Cable Address—"Missoman"

SHOWCASE . . .

New Equipment

New gate valve handles mud

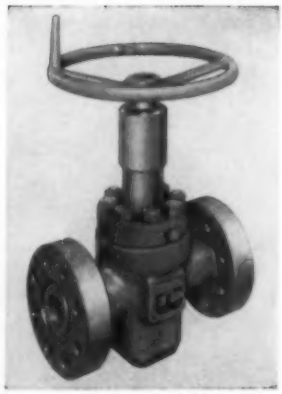
. . . or oil, gas, and water. The two seat rings on this new Type F conduit gate valve made of high-strength alloy steel. They rotate a fraction of a turn each time the gate is opened to distribute wear evenly. Guided by grooves, two sturdy dogs engage teeth around the seat rings to rotate them.

The valve is through-bored to provide smooth flow and give full opening for passage of tools. To provide a tight seal and protect working parts, the valve body cavity is filled with lubricant.

A nonrising stem operates the gate. Two needle-thrust bearings make the gate easy to open or close.

If an overload torque is applied to the hand wheel, a pin shears, preventing valve damage. Stem packing can be changed while the valve is under pressure. The gate is of one-piece construction and easily replaced.

The valve comes with screwed or flanged, ring-joint connections in 2⅛ to 6⅛-in. sizes for working pressures from 2,000 to 5,000 psi.; in 1⅝ to 4⅛-in. sizes for 10,000 psi., and 1⅝ to 2⅛-in. sizes for 15,000 psi. It's also available in special body construction for dual and triple-completion applications. **Write or call: Cameron Iron Works, Inc., P. O. Box 1212, Houston, for details on Type F conduit gate valve.**



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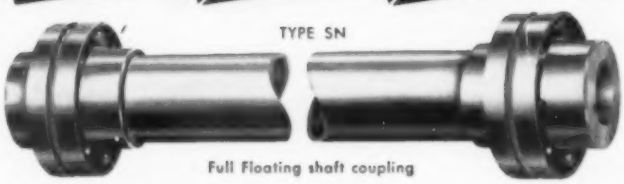
THOMAS FLEXIBLE COUPLINGS

ALL METAL

NO LUBRICATION — NO MAINTENANCE — NO WEARING PARTS



Full Floating shaft coupling

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Thomas Couplings are used to advantage on Pumps, Compressors, Cooling Towers, Rigs or any other tough job where continuous operation and dependability are required.

Future maintenance costs and shutdowns are eliminated when you install Thomas Flexible Couplings.

UNDER LOAD and MISALIGNMENT ONLY THOMAS FLEXIBLE COUPLINGS OFFER ALL THESE ADVANTAGES.

1 Freedom from Backlash Torsional Rigidity
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3 Smooth Continuous Drive with Constant Rotational Velocity
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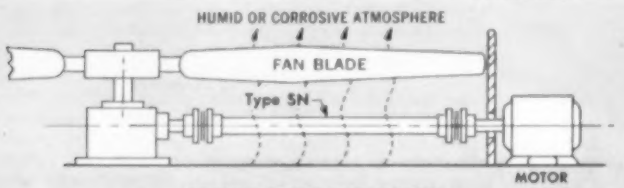
5 Original Balance for Life
6 No Lubrication
7 No Wearing Parts
8 No Maintenance



COOLING TOWER INSTALLATION

In the typical cooling tower installation shown above, the motor — outside the humid or corrosive atmosphere — is connected by a floating-shaft coupling to the gear box under the large slow-speed, horizontal-blade fan.

Write for engineering catalog 51A, and the name of your nearest Thomas representative

THOMAS FLEXIBLE COUPLING COMPANY

WARREN, PENNSYLVANIA, U.S.A.

Sonic filter

. . . offers high capacity and low power requirements, according to its maker. The new Novo sonic sifter is capable of making separations down to 30 microns. At the same time, it uses less than one-third the power and handles up to five times the capacity of present mechanically activated sifting devices, the maker claims.

In the filter screen are eight square boxes. They contain electromagnets which create a violent vibratory action on the screen mesh beneath. Through harmonics, the basic oscillation of 120 cycles per second is often built up to more than 6,000 cycles per second, according to the maker. Applications include dewatering and classifying of high-water-content slurries. **Write or call: United Specialties Co., 9705 South Cottage Grove Avenue, Chicago 28, for details on Novo sonic filter.**

HALLIBURTON'S WATERFRAC

with built-in breaker

MAXIMUM SAFETY and ECONOMY

Originally developed as a fracturing fluid for water wells, Halliburton's WATERFRAC is finding increasing application in oil and gas wells with formations insensitive to water.

WATERFRAC uses gelled fresh water, salt water or oil field brines. It combines safety, economy and convenience with its effective stimulation. Its internal breaker and dilution by water permit operation of the treated well with minimum delay.

The success of WATERFRAC in the production stimulation of oil and gas wells may be illustrated by its record: In some cases, the average sustained production after treatment has been reported to be four times initial flow!

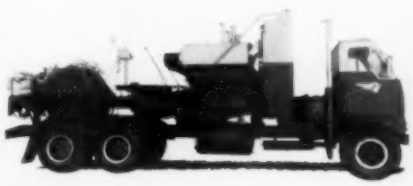
Although WATERFRAC has low fluid loss properties and carries sand well, it offers moderately low resistance to pumping. Temperature stability allows successful fracturing at bottom hole temperatures up to 200° F. Special additives may be incorporated in the gel to make it more adaptable for fracturing some formations normally adversely affected by water. In certain formations, such as limestones and dolomites, varying amounts of acid added to the gel are beneficial.

Put the advantages of WATERFRAC in your well! For more information about WATERFRAC (and many other Halliburton stimulation techniques), ask for a free copy of the newly revised bulletin, "Elements of Hydraulic Fracturing". Call your nearby Halliburton Fracturing Engineer . . . now!

FIRST AND FOREMOST IN FORMATION FRACTURING

HALLIBURTON FRACTURING SERVICES

HALLIBURTON OIL WELL CEMENTING COMPANY, DUNCAN, OKLAHOMA



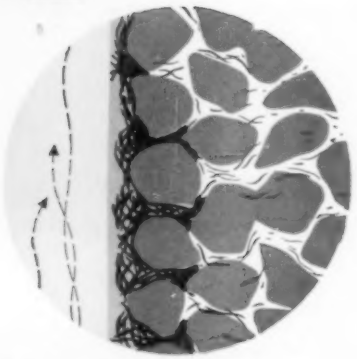
Seeing is believing...

PLUG-GIT*

Baroid's **new**

bridging fiber

combats tough cases of lost circulation



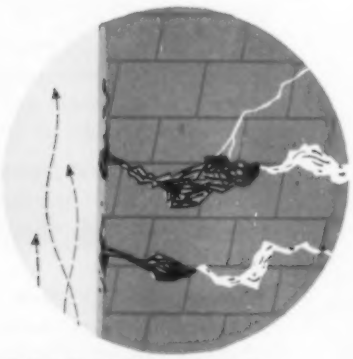
HIGH POROSITY

PLUG-GIT . . . processed hardwood fibers, controls lost circulation

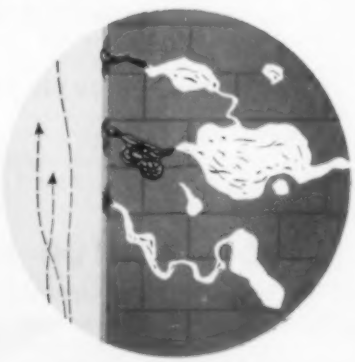
PLUG-GIT . . . quickly builds a strong, tough, matted bridge, stops mud loss

PLUG-GIT . . . easy to handle, easy to mix, economical

Specify **PLUG-GIT** and see for yourself why it wins immediate approval of drillers and engineers for combating lost circulation.



FRACTURES OR FISSURES



VUGULAR FORMATIONS

BAROID

BAROID DIVISION
NATIONAL LEAD CO.

Main Office: P. O. Box 1675, Houston 1, Texas

*Registered trademark of Baroid Division National Lead Company

B 5821

SHOWCASE . . .

New Literature

Floating plastic blankets

. . . for storage tanks are described in a new 14-page booklet. Made to measure, the plastic blankets can fit tanks from 10 to 100 ft. in diameter. Evaporation loss is considerably reduced by the installation of the blankets, the maker says. The blanket consists of a flat bottom with a vertical raised edge or skirt. The bulletin details installation and performance. **Write or call: Laroche Bouvier & Co., Div. of Petrol-Plastique, 46, Rue Des Marais, Paris, France, for Floating Plastic Blankets bulletin.**

Retarded acid

. . . developed to counteract the effect that regular acids have when they spend themselves quickly near the well bore in fast-reacting limestones and dolomites is described in a new four-page bulletin. The retarded acid contains an agent that causes a microscopic film to form. This film acts as a shield to decrease the reaction rate of the acid with the formation already contacted. **Write or call: Dowell Incorporated, Tulsa 1, for Retarded Acid bulletin.**

Pyrometer supplies

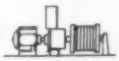
. . . Buyers Guide G100-8 is a 52-page booklet that gives descriptions of the equipment, dimensions, and prices. The booklet deals with general information about thermocouples, base-metal thermocouples, small, mass-sensitive thermocouples, noble metal and special purpose thermocouples, mounting attachments, component parts, charts, and ink. **Write or call: Minneapolis-Honeywell Co., Industrial Div., Wayne and Windrim Avenues, Philadelphia 44, for Pyrometer Buyer's Guide G100-8.**

Mud tanks

. . . design, manufacture, transport, and erection are reviewed in a new four-page bulletin. Detailed drawings show the construction features of the tanks. All parts of the units are numbered for simple construction. **Write or call: Niagara Screens, Ltd., Strays-field Road, Clay Hill, Enfield, Middlesex, England, for Mud Tanks bulletin.**

Counterflow cooling towers

. . . are discussed in new 14-page Bulletin 4.9.080A. Cross-section drawings show the general arrangement of the counterflow towers. Each cell is an independent unit. Detailed

on direct-connected motor powered equipment with high starting torque, the motor must be sized B I G for starting instead of small for running. this makes you buy more motor than you really need or use a wound-rotor type more expensive than you want. a better way is to use the small motor and drive through a National Torque Converter  this "tailors" the power to the need, multiplies maximum motor torque up to three times for starting, boosts torque instantly when overloads occur, bans motor stall and increases equipment life.

National Torque Converters help smaller motors do a bigger job

Heavy, electric-powered equipment operating on an intermittent, on-off-on-off work cycle gives motor drives a mighty tough time—unless it drives through a National Torque Converter. The converter multiplies starting torque so that a standard motor, sized to take care of the equipment's *running* needs, can supply the extra push needed for starting. Added loads imposed by multiple operations are smoothly cushioned. Shocks and strains, so hard on equipment, are absorbed. The extra cost of a special motor, and the extra day-to-day expense of operating an over-sized power plant are both eliminated.

If you are concerned with manufacture or operation of any heavy equipment where electric drives of from 100 to 1000 hp are used, the National line of Torque Converters will provide you with a unit precisely "mated" to load and application. For details write:

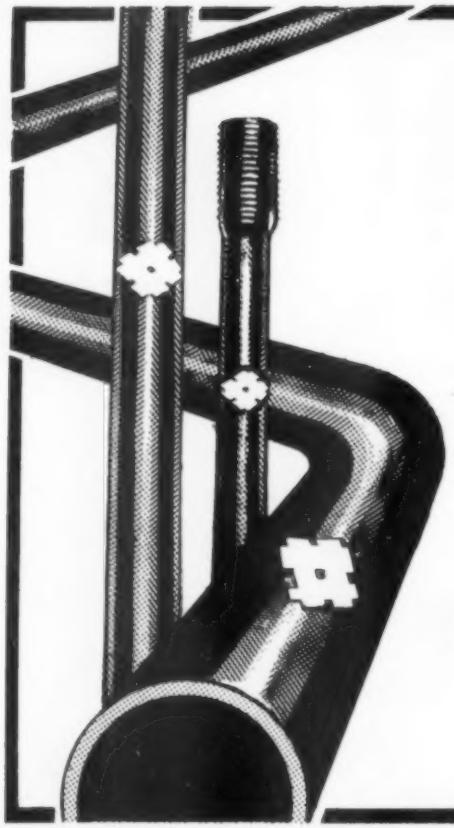
National Torque Converters are manufactured with or without integral cooling systems.

THE NATIONAL SUPPLY COMPANY

INDUSTRIAL PRODUCTS DIVISION

Two Gateway Center, Pittsburgh 22, Pa.

Pace-setters in the progress of industrial power transmission



ESTABLISHED
1897

Sumitomo Serves the World
in
Oil country Tubular goods
& Line Pipe

Now available —
Seamless Steel Pipes up to 14" O.D.

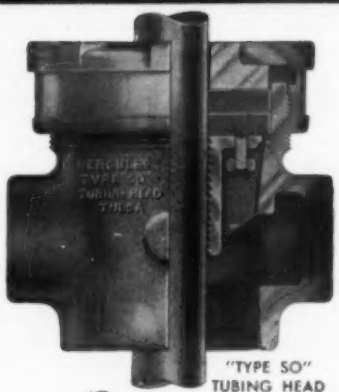
SUMITOMO METAL INDUSTRIES, LTD.

Head Office : 31, Kawaramachi 4-chome, Higashi-ku, Osaka, Japan
Cable Address: "SUMITOMOMETAL OSAKA"
Tokyo Branch : Shin-Marunouchi Bldg., 4-1 Marunouchi 1-chome, Chuo-ku, Tokyo, Japan
Cable Address: "SUMITOMOMETAL TOKYO"

there's a Hercules tubing head

TO FIT YOUR REQUIREMENTS...

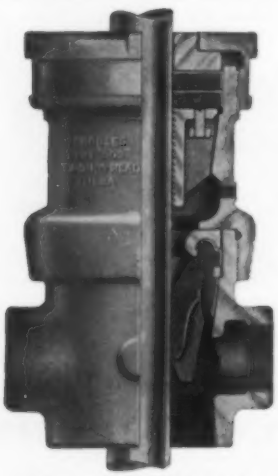
HERCULES "Type SO" Tubing Head is particularly suited for pumping due to compactness (only 12½" high). Stripper rubber can be used in body for running or wiping tubing. Also ideal for intermittently flowing wells.



"TYPE SO" TUBING HEAD

HERCULES "Type SO" and "SOS" Tubing Heads are the favorite of successful operators because of their simplicity, ruggedness and ease of operation. Available in 4½" OD to 7" OD Casing Sizes to suspend 2", 2½" or 3" tubing. Constructed from pressure cast steel and tested to 4,000 PSI. Slips are hinged for ease of installation and positive alignment.

HERCULES "Type SOS" Stripper Tubing Head is unsurpassed for use in well servicing operations as well as on flowing wells. It consists of a HERCULES "Type SO" Tubing Head with a bowl and Neoprene Tubing Stripper.



"TYPE SOS" TUBING HEAD

HERCULES TOOL Company

"MANUFACTURERS OF OIL FIELD EQUIPMENT" SINCE 1924

GENERAL OFFICES AND PLANT — TULSA, OKLAHOMA

Available through all supply stores: Export Representative: Oil Field Equipment Co., Inc., 30 Church Street, New York 7, N. Y.

information and drawings are shown for the framework, basins, fan deck and stack, filling and mechanical features, and other components of the towers. **Write or call: J. F. Pritchard & Co. of California, 4625 Roanoke Parkway, Kansas City, Mo., for Bulletin 4.9.080A.**

Metal building

. . . Catalog BD-1257 covers installations in sizes ranging from tool sheds to complete manufacturing plants. The bulletin details small buildings that are self-supporting; rigid-frame, multiple, and open-side buildings; special applications and accessories; windows, vents, louvers, insulation, and wall lining. **Write or call: Parkersburg Rig & Reel Co., Div. of Parkersburg-Aetna Corp., Parkersburg, W. Va., for Pre-Engineered Metal Buildings bulletin.**

Tension packer Bulletin 334

. . . describes a short, compact packer. It ranges from about 23 to 29-in. long. A slip type of design is featured. Designed for water flooding, the packer can be used for formation fracturing and other pressure applications, the maker says. It is recommended for use where setdown packers are impractical because of pressure requirements. **Write or call: Baker Oil Tools, Inc., Box 2274, Terminal Annex, Los Angeles 54, for Bulletin 334.**

Drilling-mud testing

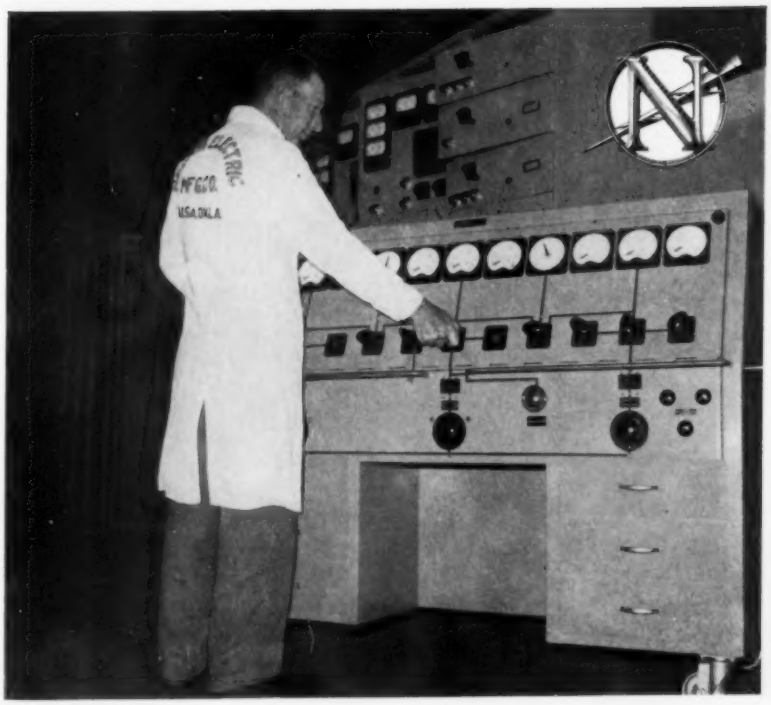
. . . equipment Catalog 31 details many of the units in a company's line. This includes a description of the equipment, specifications for a complete unit, and parts available. The equipment described ranges from mud-balance hydrometers to chemical-analysis kits. A customer price list is also included. **Write or call: Baroid Div., National Lead Co., P. O. Box 1675, Houston 1, for Catalog 31.**

Industrial weighing

. . . load measurement, and recording instruments are described in new eight-page Bulletin M-15. Crane scales, lift-truck weight indicators, tension and compression load-cell systems, crane-weight indicators, dynamometers, and tensiometers are described. **Write or call: Martin-Decker Corp., 3431 Cherry Avenue, Long Beach 7, California, for Bulletin M-15.**

Zeolite softener

. . . Bulletin 5763 is a 12-page publication that details the design and construction of CR water softeners. Charts show the hardness removed between regenerations based on the



NELSON SWITCHBOARD TESTING ASSURES PERFECT OPERATION

Nelson makes certain at the factory that your switchboards and switchgear will work right. This quality control is now possible because the . . .

NEW NELSON SWITCHBOARD TESTER DUPLICATES FIELD OPERATING CONDITIONS

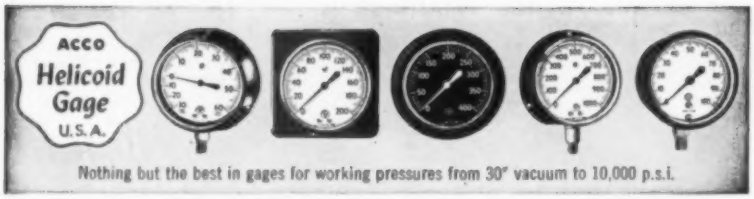
Developed by Nelson to test metering and relaying circuits of completed switchgear before shipment, this device tests potential and current circuits.

The performance of the switchboard is accurately measured. Gone is the guesswork of the old-fashioned continuity tests that showed only whether or not the switchgear was wired as shown on the wiring diagram.

This test gives both Nelson and the customer the satisfaction of KNOWING that the equipment is *right* as it leaves Nelson's plant, and is going to function in the field when properly installed.

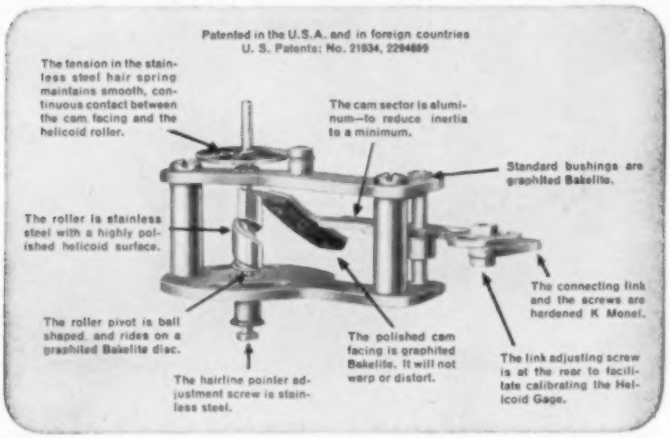
a major source of electrical control equipment for industry

NELSON *Electric* MANUFACTURING CO.
TULSA, OKLAHOMA



Nothing but the best in gages for working pressures from 30" vacuum to 10,000 p.s.i.

These details of Helicoid gage design assure longer life and enduring accuracy


Patented in the U.S.A. and in foreign countries
U. S. Patents: No. 21934, 2294889
The tension in the stainless steel hair spring maintains smooth, continuous contact between the cam facing and the helicoid roller.
The cam sector is aluminum—to reduce inertia to a minimum.
Standard bushings are graphited Bakelite.
The roller is stainless steel with a highly polished helicoid surface.
The connecting link and the screws are hardened K Monel.
The roller pivot is ball shaped, and rides on a graphited Bakelite disc.
The polished cam facing is graphited Bakelite. It will not warp or distort.
The link adjusting screw is at the rear to facilitate calibrating the Helicoid Gage.
The hairline pointer adjustment screw is stainless steel.

The superiority of Helicoid Gages is most evident in severe service—wherever a gage is subjected to violent pressure pulsations or severe mechanical vibrations.

The *sustained accuracy* of Helicoid Gages over *millions of cycles* is explained by the details of design and construction of the Helicoid movement shown above. Such Helicoid features—protect against wear and corrosion and assure sensitivity, sustained accuracy and trouble-free operation.

Easiest adjustment and calibration

Only Helicoid Gages have the external pointer adjustment pictured here. The Helicoid type adjustment cannot be jarred out of position.

Calibration of Helicoid Gages is accomplished easily, without removing dial or pointer, because the link adjusting screw is at the rear of the system.

Tubes built for millions of pressure pulsations

To fit the wide range of applications, Helicoid Bourdon tubes are available in four materials —alloy steel, K Monel, stainless steel and phosphor bronze.

All Helicoid tubes are made from seamless tubing and are carefully designed to give maximum torque and minimum stress. When used within the dial range, they will withstand many millions of pressure pulsations and will not stretch, leak or crack.

For complete information on the Helicoid line of gages write for **Catalog G-52**

Helicoid gives you all these features at prices that are competitive in the quality gage field.

Helicoid Gage Division
AMERICAN CHAIN & CABLE

929-A Connecticut Avenue • Bridgeport 2, Connecticut

ACCO
TRADE MARK

service and backwash rate, zeolite, pipe and meter size, shell height, and diameter. Charts detail the softener and regeneration units. **Write or call: General Filter Co., Ames, Iowa, for Bulletin 5763.**

Crimped finned tubing

. . . is discussed in a new four-page bulletin. The finned tubing is helically wrapped. Tubes from ⅜ to 1¼ in. o.d. can be fitted with fins from ⅛ to 1 in. high. Fins can be spaced from 3 to 10 per inch in fractions. Details on quotations are included. **Write or call: Keeprite Eastern, Inc., 459 Amboy Avenue, Woodbridge, N. J., for Crimped Finned Tubing bulletin.**

Cooling-tower performance

. . . is discussed in two new reprints now available. "From the Top of the Deck" is a four-page reprint that deals with industrial controls. It shows how controls at the cooling-tower laboratory increase accuracy of test data and reduce manpower and research time. "Comparative Performance of Cooling-Tower Packing Arrangements" deals with specific performance and pressure-drop characteristics of the types of cooling-tower packing arrangements now in use. **Write or call: J. F. Pritchard & Co. of California, Div. of J. F. Pritchard & Co., 4625 Roanoke Parkway, Kansas City 12, Mo., for Cooling Tower reprints.**

Storage-tank cleaning

. . . and paint stripping is the title of new refinery maintenance Bulletin 2. The bulletin discusses cleaning of storage-tank interiors by spray application of a detergent solution to remove medium-heavy soils, or by fogging with solvent followed by spraying and soaking to remove heavier soils. Cleaning of exterior tank surfaces with solvent or alkaline detergent is discussed, as well as paint stripping. **Write or call: Oakite Products, Inc., 159 Rector Street, New York 6, for refinery maintenance Bulletin 2.**

Coupling brochure

. . . describes a company's Model B couplings that are an all-steel self-aligning gear type. They are produced for shaft sizes up to 3⅛ in. The brochure outlines the main features of the coupling and describes the double-engagement design that compensates for misalignment of the shafts. Ratings and dimensions of the couplings are also included. **Write or call: Koppers Co., Inc., Metal Products Div., Baltimore 3, Md., for Model B Coupling brochure.**

The kitchen sink is one thing
that we don't regularly stock at HOMCO Supply
Stores.....but we'll get it for you if you need it.
Whatever you need in the oilfields,
HOMCO HAS IT.

HOMCO
HOUSTON OIL FIELD MATERIAL COMPANY Inc.
HOUSTON, TEXAS

THE WORLD'S LARGEST INDEPENDENT OILFIELD SUPPLY AND SERVICE ORGANIZATION

RESEARCH • ENGINEERING
DEVELOPING • MANUFACTURING

DIRECTIONAL DRILLING • FISHING & CUTTING • ELECTRICAL WELL SERVICES • OILFIELD SUPPLIES • EXPORT TOOLS & SERVICE

Industrial Controls Div. Names E. R. Lehmann . .

as manager of application engineering for the division of Manning, Maxwell & Moore, Inc., according to Karl W. Peterson, divisional sales manager.

Previously, Lehmann was with Fisher & Porter (Canada), Ltd., and McColl-Frontenac Oil Co.

The Industrial Controls Division is a manufacturer of electronic process control systems for controlling pressure, temperature, flow, liquid level, pH, and other process variables.

Aero Design & Engineering Co. May Be Subsidiary . .

of Rockwell Spring & Axle Co. of Coraopolis, Pa., according to George T. Pew, chairman of the board and president of Aero. Pew stated that an agreement provides maintenance of a separate corporate entity for Aero and contemplated that the existing management group will remain in charge.

The acquisition is to be accomplished by an exchange of stock whereby shareholders of Aero receive an interest in Rockwell stock, and Rockwell acquires Aero as an operating subsidiary. Pew noted that the agreement requires approval by the stockholder groups and is subject to a registration statement with Securities Exchange Commission before becoming effective.

Cooper-Bessemer Corp. Names R. L. Kietzman . .

R. L. KIETZMAN

to sales engineer for its St. Louis branch office, according to Grant C. Woodard, general sales manager.

Working under F. J. Hunter, branch manager, Kietzman will be responsible for engineering and sales contacts in the Missouri and southern Illinois areas. He has been with the company's product departments for the past 2 years.

Cummins Engine Co., Inc., Plans Increase . .

in the trucking field during 1958. J. Irwin Miller, board chairman of Cummins visited Fort Worth recently and discussed sales plans with Ken W. Davis, president of Cummins Sales & Service, Inc.

Miller emphasized that the new 672 cu. in. NH-180 diesel was designed particularly to meet trucking requirements in the Mid-Continent area, as well as east and south. The 180 hp. engine was developed from the basic components of the larger 220 hp. Cummins NH-200. Davis and J. T. Calnon, vice president, sales, projected 1958 sales of Cummins Sales & Service above 1957's sales record.

Davis sold his first Cummins engine in 1933 for 1934 delivery. Cummins Sales & Service has 18 shops and sales points in Texas, Oklahoma, Louisiana, Kansas, Mississippi, and New Mexico. Three shops in Venezuela were recently added operating as Cummins Sales & Service de Venezuela, C. A., under the supervision of Vice President L. J. Troutz.

Officials of Cummins Sales & Service and Cummins Engine discussing sales plans in Fort Worth are L. J. Troutz, Ken W. Davis, J. Irwin Miller, and J. T. Calnon.

R. C. Holden Becomes Vice Prexy, General Manager . .

R. C. HOLDEN

of Harrisburg Sales & Service, Inc., President Ken W. Davis announced. Holden will headquarter in Houston, location of the company's manufacturing facilities.

Holden has been sales engineer in Dallas for Mid-Continent Supply Co. He replaces A. B. Quinn who resigned from Harrisburg.

Harrisburg manufactures and markets diamond hard products and oilfield specialties.

Welex, Inc., Opens New Operating Base . .

for oil-well service on the new expressway at Harvey, La. The building and facilities are designed and equipped to offer maximum service and communications to the oil industry in South Louisiana.

One principal operation there will be wireline skid units located on offshore drilling platforms and mobile rigs. This department is under the direction of Dean W. Kelley and includes field operating engineers, Charles W. Tipps, Doyle J. Prince, J. L. Everett, and Ned A. Miller.

Division engineering offices and laboratories are included in the installation headed by W. R. Jay and Lewis A. Cobb.

Welex is installing its own radio station with a 340-ft. antenna tower and a special beam antenna directed to offshore operations.

Headquarters of the Louisiana Gulf Coast division are in New Orleans with J. B. Fleming, vice president and division manager in charge. W. L. Laflin is assistant division manager.

D. L. Whatley Appointed City Representative . .

at Wichita Falls, Tex., for U. S. Steel's Oil Well Supply Division, according to William Miskimins, Central Midwest area manager.

Whatley was employed by Oilwell at Wichita Falls in 1948 and appointed field representative there in 1949. In 1953 he became store manager at Gainesville, Tex., the position he held prior to his present appointment.

W. A. Davidson Named Special Representative . .

of sales for Herb J. Hawthorne, Inc., manufacturer of rotary bits. Davidson's appointment was announced by Jack W. Thigpen, sales manager.

Previously with an oil industry supply firm, Davidson served as division manager for West Texas-New Mexico, and more recently as division manager in charge of industrial sales for Houston area before joining Herb J. Hawthorne.

J&L Supply Division Names Wehrley and Weldon . .

to district sales manager of East Texas at Longview, Tex., and manager of Canadian region at Calgary, Alta., respectively, according to W. L. Wolfe, vice president, sales.

A. G. Wehrley succeeds M. L. Eubank who recently retired. Wehrley joined J&L Supply in 1947 as salesman at Tulsa. In 1950 he was made

A. G. WEHRLEY

V. WELDON, JR.

senior field salesman and transferred to Ballinger, Tex. He was promoted to assistant district sales manager of the East Texas district in 1953 and moved to Longview.

V. H. Weldon, Jr., succeeding H. L. Wilkins who retired, joined the division in 1946 as storeman at Carmi, Ill., and was promoted to salesman at Clay City, Ill., later in that same year. He transferred to Oklahoma City in the same capacity in 1948. He moved to tubular sales department in 1949 and became tubular goods salesman at Houston.

He was boosted to assistant district sales manager of Southwest Texas in 1952 at Corpus Christi, Tex. He advanced to district sales manager there in 1954, and was named assistant manager of Canadian operations and transferred to Calgary in 1956.

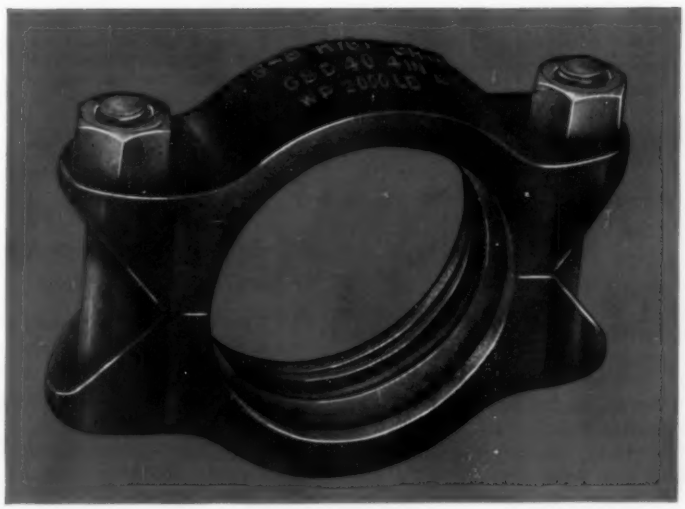
R. F. Klein Appointed By Walworth Co. . .

as manager of lubricated plug valve sales for the valve and pipe fitting manufacturer.

Prior to his appointment, he was sales engineer in the company's metro-

RIGI-GRIP

For the RIGID coupling of grooved pipe



ANOTHER GUSTIN gb BACON FIRST

Now, wherever you want complete rigidity in a grooved pipe installation, you can get it! And you can get it in a tested-and-proved, rugged, easy-to-install coupling that gives you 2,000 lbs. working pressure. It's the All New Gustin-Bacon Rigi-Grip . . . a coupling that puts an end to "floating" lines, eliminates the need to spend time and money on bracing or other types of support.

Gustin-Bacon, FIRST to give you a dependable coupling for plain end pipe (the famous G-B Rolagrip), FIRST with a coupling for low working pressure grooved pipe (Gruvajoint).

And now another G-B FIRST, one that will be hailed wherever rigidity in grooved pipe is wanted! For instance: oil field tank batteries, oil well production headers, water flood pump house and field service lines, to name only a few of its many applications. Get all the details today! Ask at your nearest oil field supply store, or write directly to Gustin-Bacon.

Easy-to-install Rigi-Grips are available in 2, 2½, 3, 4 and 6-inch sizes. For lines carrying virtually any type of fluid or material, they are reclaimable, each coupling forming an easy-to-take-apart union.

GUSTIN-BACON Manufacturing Company

210 West Tenth Street, Kansas City, Missouri

politan division, specializing in sales to the gas distribution industry. He joined Walworth in 1945 and has experience in the application and sale of lubricated plug valves in the oil and gas industry.

He will headquarter at the general office in New York City.

D. F. Tver, Harry Mayne Elected to Key Posts . .

of the Petty Geophysical Engineering Co.

Tver was elected executive vice president and Mayne was elected vice president of technical services.

D. F. TVER

HARRY MAYNE

Before joining Petty, Tver was with Anderson-Prichard Oil Corp. in Oklahoma City. Mayne is a 20-year veteran with Petty.

Mission Manufacturing Co., Ltd., Has New Plant . .

operating in Belfast, Northern Ireland, Richard E. White, chairman of the overseas affiliate, has announced. White is president of Mission Manufacturing Co., Houston.

Equipped with the latest machine tools from Britain, Germany, and Switzerland, this manufacturing plant contains 35,000 sq. ft. of space, with 26,000 sq. ft. being devoted to manufacturing. The remaining space is used for offices.

The plant's output at this time includes Mission pistons and piston rubbers, self-sealing gland packing, piston rods, E-Z swabs, Mud Monarch valves and seats, and Silver Top valves and seats.

The managing director of the overseas affiliate is Robert H. Anschutz. Mission established a sales office in London in July of 1955 with W. C. Talbert, Jr., as sales manager.

Jack D. Zinser Appointed Sales Representative . .

for Wolverine Tube, division of Calumet & Hecla, Inc., in western Pennsylvania area, according to R. B. Flynn, East Central district sales manager.

Zinser will concentrate his efforts on the sales and promotion of copper, brass, and aluminum tubular products. He will headquarter at the Pittsburgh office.

W. L. Legro Forms Port Houston Manufacturing . .

after acquiring Brinkman Tank, Inc. The new corporation, located just off Clinton Drive in the Galena Park area of Houston, has already begun production of heavy oil-field and processing equipment.

Legro is president of the new firm. The plant is on a 5¼-acre site, with rig-up yards covering 2¾ acres. The plant includes 25,000 sq. ft. of shop space and an office building. The firm will manufacture ASME code pressure vessels, large diameter pipe, and casing. Its primary business will be plate fabrication.

The oil-field supply division of Port Houston Manufacturing will, for the present, concentrate on export trade. It is licensed to manufacture Medearis Oil Well Supply Co.'s mud mixer and shale shaker. Mud-control systems, utility houses, and other equipment will also be produced by the division.

The firm has export representatives in New York and Los Angeles and will establish one in Houston.

Port Houston Manufacturing Corp.'s plant at Houston.

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&
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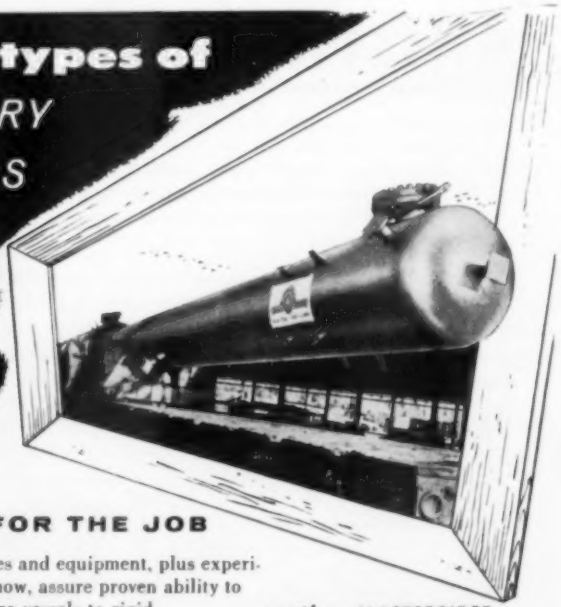

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Master also produces API 5LX HI-TEST Expanded Line Pipe

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RCA Service Co. Names D. O. Reinert to New Post . .

of manager, mobile and microwave service sales, technical products department, according to A. Fischer, manager, sales and merchandising.

Reinert joined RCA as student engineer in 1948. Later he served successively as mobile equipment field salesman and district mobile equipment sales manager, northeastern region. Prior to assuming his new position, he had been administrator, mobile equipment field sales coordination.

Delta-Desco Cos. Open New Sales-Service Office . .

in Chicago. C. V. Neyland will be in charge of this territory, which includes the north half of Illinois and northwestern Indiana.

Prior to moving to Chicago, Neyland was division manager of the Oklahoma-Kansas division.

Delta-Desco manufactures valve lubricants and lubricating equipment, and also operates a fleet of valve lubrication and service units in the petroleum and chemical industries.

E. Z. Walden Named Export Sales Representative . .

by Baroid Division, National Lead Co. He will work in a dual capacity, serving also as sales engineer for Baroid Chemicals, Inc., in the New York district.

Walden spent 4 years with Mellon Institute in Pittsburgh on a fundamental study of starch chemistry.

Dual Rambler Rig to Be Displayed At Brussels

The precision working model of Ideco, Inc.'s H-40-D rig will be displayed in Brussels, Belgium, at the World Fair in the Belgian exploration and production section of the Pavilion of Oil Industries by Petrofina (Compagnie Financiere Belge Des Petroles), a Belgian oil company.

Built on a scale of 1 ft. to 20, the model is complete in detail from the cross-over crown block at the top to the miniature drive-over ramps. In all respects, it is ready to "make hole."

Fully rigged up in operating position, the mast towers almost 6 ft. in the air. Over-all, with catwalks and ladders in position, the 2-trailer model is 67 in. long and 17 in. wide.

The rig is powered by two Caterpillar D-337 diesel engine models. Concealed under the draw works is a small electric motor which provides actual power for raising and lowering the mast, telescoping the upper section, and raising and lowering the traveling block.

An Ideco employe at Beaumont, Tex., Guy Hardin, built the model in his home workshop. More than 6 months of precision work was required for the project.

Russell Engineering Corp. Employs C. M. Furgason . .

as engineer and office manager. He will devote the majority of his time to design, estimating, and purchasing for the construction of gas and other types of processing plants.

He worked as process engineer with

WHO specifies
WISCONSIN
heavy-duty Air-Cooled
ENGINES?

A Good Question . . .
and here's the answer

IT'S the seasoned "professionals" . . . qualified men like yourself, who *know engines* and the operating demands they must meet in rugged field service, who specify "Wisconsin Power" . . .

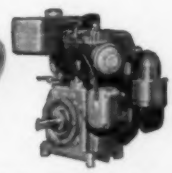
Men like *you*, who have had the opportunity to compare and weigh performance characteristics of engines on your own equipment, under your conditions;

Men like *you*, who appreciate the advantages of Wisconsin heavy-duty design and construction in all details . . . in terms of operating dependability; low-cost maintenance and long engine life;

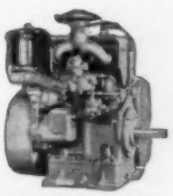
Men like *you*, who know the value of Wisconsin High Torque engineering and performance . . . to give you the load-holding *Lugging Power* that hangs on through the shock-load pinches without stalling;

Men like *you*, who have learned from experience that there is no substitute for Wisconsin trouble-free AIR-COOLING . . . efficient at all temperatures from sub-zero to 140° F.

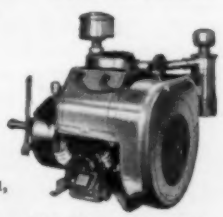
Full scale *specialization* in the manufacture of heavy-duty air-cooled engines and a full line of 4-cycle single cylinder, 2- and V-type 4-cylinder models from 3 to 56 hp. (all models can be equipped with convenient, quick-action ELECTRIC STARTING) are additional reasons why *power professionals*, like you, specify "WISCONSIN." Write for engine bulletin S-223 for a briefing on the full line.



• 4-cycle single cyl., 3 to 12½ hp.



• 2-cylinder, 10 to 18 hp.



• V-type 4-cyl., 15 to 56 hp.

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World's Largest Builders of Heavy-Duty Air-Cooled Engines

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Tennessee Valley Authority in Florence, Ala. Later, he was research project leader at the University of Texas on high-pressure reenforced plastics. He was self-employed for a number of years in Central Texas. In 1951 he joined Thermal Products Co. as an engineer.

Roy Perkins Joins Harold Brown Co. . .

as a sales engineer, Harold Brown, president, has reported. Perkins will serve the eastern Louisiana Gulf Coast area with headquarters in New Orleans.

Before joining Harold Brown, Perkins has been active as a petroleum consultant involving reservoir analysis, completions, and remedial work.

Prior to that he was a senior engineer with Schlumberger Well Surveying Corp.

E. A. Fischer Joins Engineering Staff . .

of John Zink Co., manufacturer of industrial and domestic heating equipment.

He formerly was sales engineer for 10 years with J. Arthur Moore Co., exclusive representatives for Zink in the New York-Philadelphia area.

Last year he conducted experiments on the Zink research and development furnace with engineers from major oil companies.

Collins Radio Co. Reports Consolidation . .

of research, development, sales, and manufacturing activities in its Texas division to concentrate on microwave communication systems.

The emphasis on microwave specialization has been accomplished by divisional reorganization, selection of key personnel, and addition of microwave specialists. This increases capacity and potential of supplying equipment and systems to petroleum and industrial users of microwave for communication and control facilities.

General manager of the Texas division is Vice President Max W. Burrell. Headquarters for Collins' domestic and international sales organization, directed by Vice President J. G. Flynn, Jr., remains in Dallas and is not affected by the reorganization.

Baash-Ross Division Holds Preview Showing . .

of several new oil-field products for members of the sales organization of this division of Joy Manufacturing Co. during a recent 4-day national sales meeting in Houston.

Sessions were conducted by G. D. Johnson, vice president and general manager; H. L. Messinger, general sales manager; E. C. Zografos, manager of advertising and sales promotion; and E. R. Lindgren, chief engineer.

Sales representatives and officials at the meeting were, front row: Gordon Morrison; Bob Prichard; Gordon Rogers; Bob Brenner; Howard Clark; Joe Terrell; Ed Luce; Willie Carothers. J. A. Noyes; and Al Ogle. Seated are: Elmer Hutchins; J. W. Thornton, vice president in charge of marketing, Joy Manufacturing; B. Bronzan, general operations manager; Hal Messinger, general sales manager; Glenn Johnson, vice president and general manager; Emory Streight; Ora Brown; E. R. Lindgren, chief engineer; Tom Morrow; Len Snyder; and Harry Pigman. Standing are: Chuck Bridges; Johnnie Mays; Jim Ward; Perry Pound; Al Schoettler; E. J. Frederick; Dick Meekins; Moore Sinclair; Bob LeBus; Jack Brunt; Tom Ray, Jr.; Jean Guibout; George Hummell; E. Barkley; Harry Siegley; Glenn Huckabay; Fred Waller; Dave Christian; Craig Mays; Cecil Hollingshead; Roger Smith; Harold Whietley; Wayne Cleveland; DeWitt Dees; Gus Gondran; Bill Segovia; and Zeke Zografos. Back row are: Zeke Browning; Don Kerns; Charlie Hutchinson; Ben Lane, export manager, Joy; Wendell Gordon; Herb Klepfer; Gene Maxwell; Bobbie Westerman; Ed Rogers; and Milburn McNeeley.

W. H. Fellows Appointed National Sales Manager . .

W. H. FELLOWS

by Ohio Injector Co., G. Richard Winder, vice president of marketing, has announced. Fellows, who was an engineer with National Bureau of Standards, most recently has been a vice president of Abrasive & Metals Products Co., Detroit.

In his new assignment with the industrial valve manufacturer, he will supervise marketing aspects of a new company program aimed at intensifying its engineering and marketing services to the petroleum, chemical, utility, and shipbuilding industries.

Beckman-Systems Division Names J. H. Gibbs . .

as field engineer in its new Houston field office, according to Frank J. Scheufele, sales manager.

Gibbs will service the division's customers in southwestern states. He has been with the division since 1956 in the sales department. Prior to this time, he was with Bill Jack Instrument Co. as field representative for 3 years and with Solar Aircraft Co. as technician for 2 years.

P. A. Wagstaff Named Division Manager . .

of the newly-organized Kansas division of Welex, Inc. Division offices are in Wichita.

This division includes districts in Great Bend, with H. L. Kendall as manager; Hays with J. W. Pickering as manager; Pratt with C. P. Stewart as manager; Winfield with L. M. Bullock as manager; Crossville, Ill., with J. J. Weathers in charge; and Salem, Ill., with L. G. Harris in charge.

Other Kansas personnel include W. B. Clark, assistant division manager; Jack Wheeler, division sales manager; and R. H. Mallett, Jr., division sales engineer.

S. A. Marczak Joins . .

Field Measurement Service, in Victoria Tex. The firm is engaged in work relative to orifice meter, chart computing, specific gravity, and witness test services.

Larkin Packer Co. Builds Three New Warehouses . .

and replaces another. New installations are at Farmington, N. M.; Harvey, La.; and Pampa, Tex. The replacement is at Odessa, Tex. Each warehouse is 40 by 100 ft.

In Odessa, Larkin's installation will serve West Texas and part of New Mexico. Store manager is T. H. Lampe. From Farmington, Larkin will supply oil industry needs for Four Corners area. Store manager is Sanford Newman.

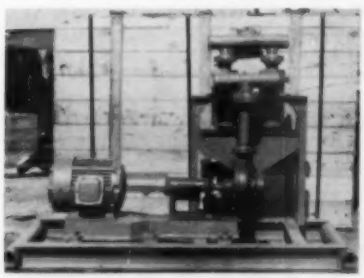
The Pampa unit services western Kansas and the Panhandle. Store manager is W. B. Cotton. At Harvey, under store management of Sam Gibbs, South Louisiana is served.

Continental-Emsco Co. Makes Personnel Changes

Joseph F. Harris was named D+B specialist at the Borger, Tex., store. He formerly was a sales representative at this point.

Export changes include George P. Daley, former sales representative in Buenos Aires, Argentina, to export sales representative in the New York home office. The Houston export office has appointed George A. Stout as supervisor of export traffic and purchasing.

Reynaldo C. Gonzales has been appointed field salesman at Las Morochas, Venezuela. He was formerly stationed in New York.



Size 2 Dorrco D-Sander Loaded At New Orleans . .

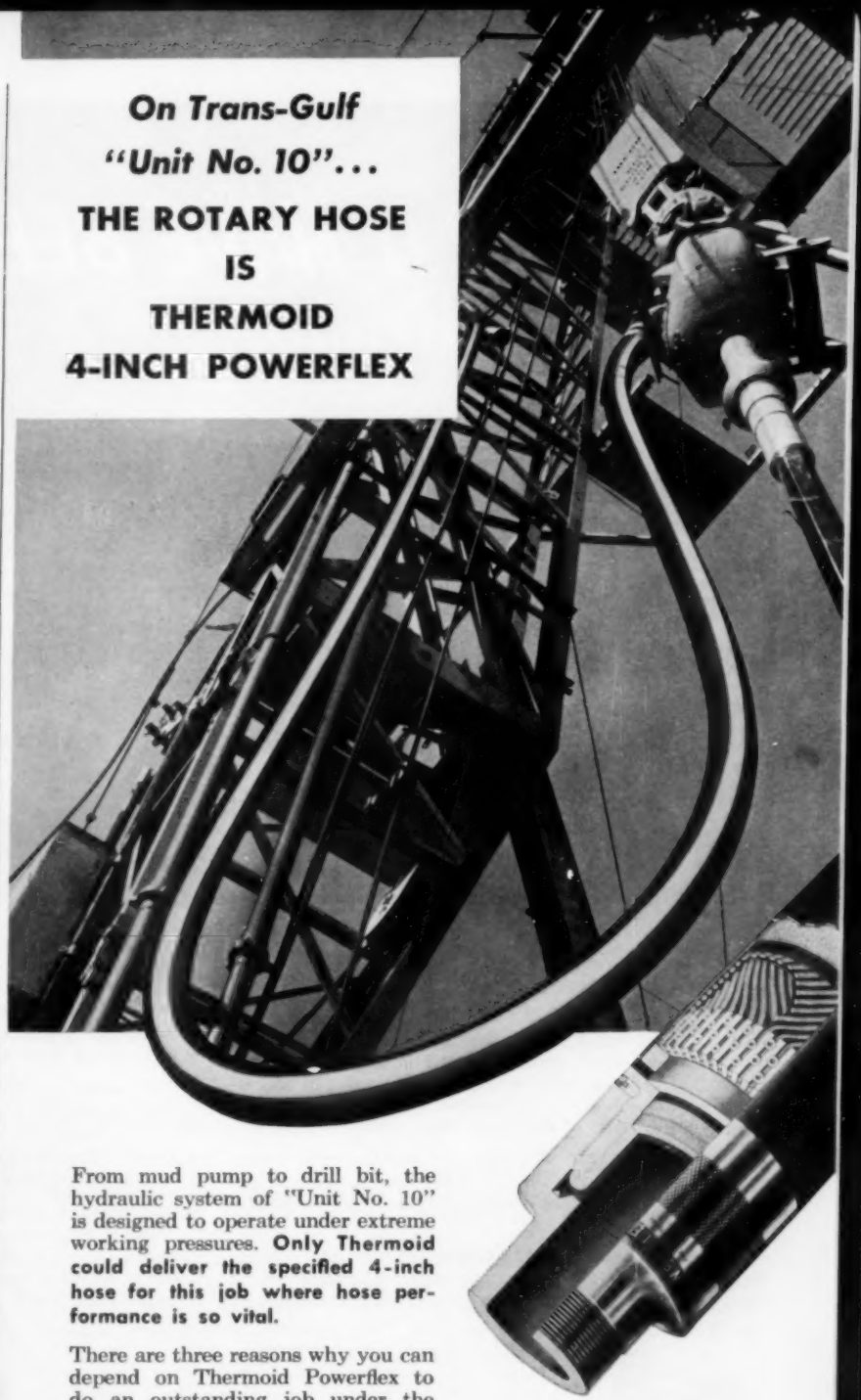
to be shipped to the Middle East. It is equipped with a Mission Manufacturing Co. centrifugal pump.

Manufactured by Dorr-Oliver, Inc., the unit was sold by Salt Water Control, Inc., Fort Worth. The D-Sander has a capacity up to 250 gal. a minute. The unit conquers the problem of abrasive sand in drilling fluid, thus increasing life of bits and pump parts.

The unit will be put to use by Arabian American Oil Co.

On Trans-Gulf "Unit No. 10"...

THE ROTARY HOSE IS THERMOID 4-INCH POWERFLEX



From mud pump to drill bit, the hydraulic system of "Unit No. 10" is designed to operate under extreme working pressures. **Only Thermoid could deliver the specified 4-inch hose for this job where hose performance is so vital.**

There are three reasons why you can depend on Thermoid Powerflex to do an outstanding job under the toughest conditions. *First* . . . the patented full flow coupling is an integral part of the cable. It cannot leak or pull off. *Second* . . . the cable itself is made up of 33 miles of high tensile steel wire wrapped and counterwrapped for unexcelled strength and flexibility. *Third* . . . the tube and cover of Powerflex Hose are made with oil and abrasion resistant Neoprene, reinforced with impregnated multi-ply woven fabric.

Superior design and superior construction make Thermoid Oil Field Products the right choice for you . . . for both routine and unusual jobs.

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And so they kicked the core off the catwalk and went home. Another hole chalked up in the D&A column.

So near, yet so far? It wasn't that the operator, or his field representative, didn't need additional information. It was simply that someone failed to recognize the value of obtaining *direct measurements* on samples of the formation rock — *the original goal of the entire venture.*

This is not to say that core analysis would have made it an oil well, but if all the core that has been kicked off the catwalk had been analyzed, there would be many more fields in operation.

Of course, core analysis can't change the facts of nature — but without it you cannot properly evaluate them. Smelling, tasting, and visual inspection are not enough. The elementary knowledge that core contents are subjected to flushing, expansion, and expulsion actions from the moment a sample is cut until it reaches the surface, precludes the accuracy of this derrick floor habit.

Core analysis, as Core Lab performs it, means the scientific "reconstruction" of original fluid contents and their relationship to accurately classified physical characteristics of the rock — and, of equal importance, a summary and interpretation of these measured data.

No one needs to be reminded that oil is harder to find. You know it. We know it. And it's our business to help you beat the law of averages. Next time, schedule a Core Lab man to meet the core, sample it, and give you the benefit of his experience. You'll be glad you did.

Interested in average productive characteristics of certain formations in South Texas, Rocky Mountains, East Texas, North Louisiana, and Arkansas? Individual brochures on these areas are available. Forward inquiry to address below.

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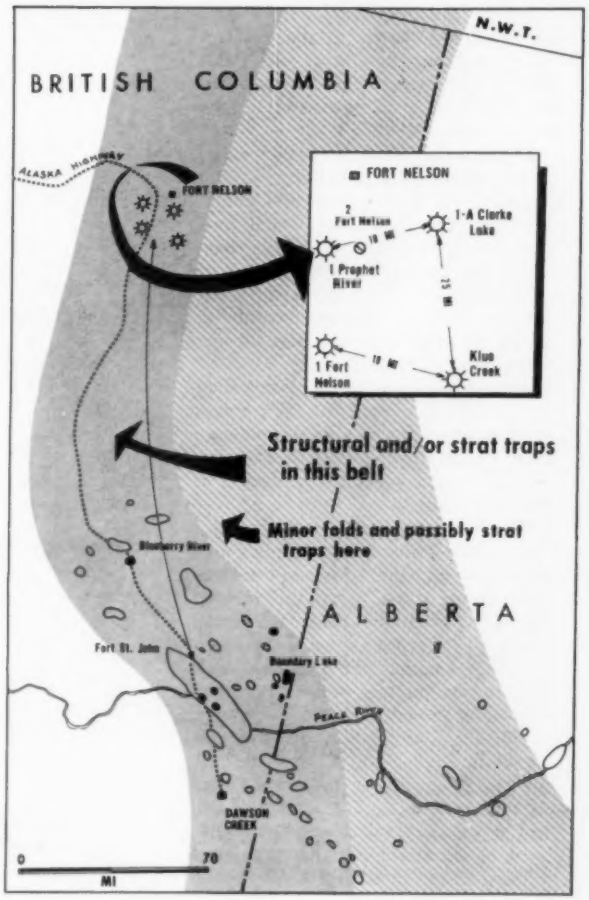
Gas heads north in British Columbia

BY NORMAN S. MORRISEY
Drilling-Development Editor

OPERATORS are quietly pushing the quest for gas farther and farther northward from the 5 trillion cubic feet of reserves blocked out in the Fort St. John area. They are meeting with notable success at Fort Nelson, extending gas play 175 miles. For a short time, oil strikes shunted gas exploration into the background. But the four strikes at Fort Nelson could easily be the forerunner of a vast new gas field, comparable to the multipay fields at Fort St. John, Boundary Lake, and the more recent oil and gas strikes at Blueberry River.

Fort Nelson had an inauspicious beginning. However, the four discoveries now embrace nearly 400 sq. miles that are potentially productive. Both Mississippian and Devonian reservoirs are gas-bearing to enhance the economics of the play.



A NEW ERA of gas exploration is unfolding in the far northern reaches of British Columbia. Gas in Canada's "gas province" is moving north of the Peace River country.

Clarke Lake . . . Gulf States Oil Co. of Canada and El Paso Natural Gas Co. have logged the latest discovery, a lush 82 ft. of Devonian dolomite that tested better than 8 M.M.c.f.d. during drilling operations. The well, the 1-A Clarke Lake, is a twin to an abandoned test that blew out in January 1958 at 1,867 ft., flowing an estimated 3 to 5 M.M.c.f.d. from the Mississippian. Mechanical difficulties later forced the operator to plug the 1 Clarke Lake and commence the 1-A. The latter is now temporarily shut down because of the pending spring breakup at total depth of 6,438 ft. Operators have confirmed that the Clarke Lake strike could prove to be a major discovery.

Prophet River . . . Actually the Clarke Lake gasser is the third Slave Point producer in the Fort Nelson area. Ten miles to the southwest, Gulf States and El Paso tapped Devonian gas at their 1 Prophet River, but no details are available on this Devonian discovery, completed in 1957. The companies are now currently drilling ahead at the 2 Fort Nelson below 4,000 ft.; this well is halfway between the Clarke Lake and the Prophet River discoveries.

Klua Creek . . . Shell tapped the first Devonian production in the Fort Nelson area with the 1 Klua Creek. It logged 62 ft. of gas pay at 6,818-80 ft., probably Slave Point. The well flowed 12,000 M.c.f. per day on test during drilling operations. Klua Creek lies some 25 miles south of Clarke Lake and slightly to the east.

Pacific Petroleums is currently drilling ahead below 6,950 ft., after testing two zones in the Mississippian at its 1 Fort Nelson. The well flowed at the rate of approximately 2,000 M.c.f. per day from the interval 2,305-2,458 ft. A second zone, 2,720-74 ft., also in the Mississippian, flowed 1,400 M.c.f. initially on drill-stem test, but the flow had decreased to 800 M.c.f. by the end of the test.

Combined structural and strat traps . . . Production in the general Fort St. John area is controlled by both structure and stratigraphy. Many of the fields are evident only as noses and several have tilted water tables. The trends lie northeast of the complex foothills folds and on the stable shelf portion of the basin. Quite probably similar conditions will prevail in the Fort Nelson area. In short, production will be related to both structure and stratigraphy, and new fields found could easily develop into major oil or gas reserves.

Thus far much of the exploration and drilling have been confined to areas served by the Alaskan Highway, or adjacent to it. But with the constant demand for new gas reserves to quench the thirst of the Pacific Northwest, we will see many strat tests drilled in British Columbia. The prospects for substantial reserves appear excellent. Undoubtedly similar production will be found between Fort Nelson and Fort St. John, and the trends will be pushed farther northward, even into the Northwest Territories.

I found oil

by using sound subsurface geology – and a little luck

BY T. E. PEELER
Corpus Christi, Tex.

LUCK played a very important part in the discovery of Johns Hockley field, Duval County, Texas.

Before the discovery, I had concentrated my efforts in the Jackson trend, mapping the larger old fields along it. I hoped to find an undrilled field location or a new sand on the known anomalies.

Fortunately, I found what appeared to be an undrilled location in old Fitzsimmons field in Duval County. The up-to-the-coast fault which controls production there traversed diagonally across the southeast corner of an open tract of acreage a sufficient distance from the southeast corner to justify an additional location for the Pettus sand in the field (Fig. 2).

The outer pair of heavy dashed lines on Fig. 2 represent fault traces at Hockley depth; the inside lines are fault traces for the Pettus. You can see how much wider the graben is at Hockley depth.

The east fault is the up-to-the-coast fault which controls Fitzsimmons production and the down-to-the-coast fault on the west forms the western boundary of Johns field. The small triangle of acreage shown in black on the map encloses the proposed well site. It was on this premise that the first acreage was acquired.

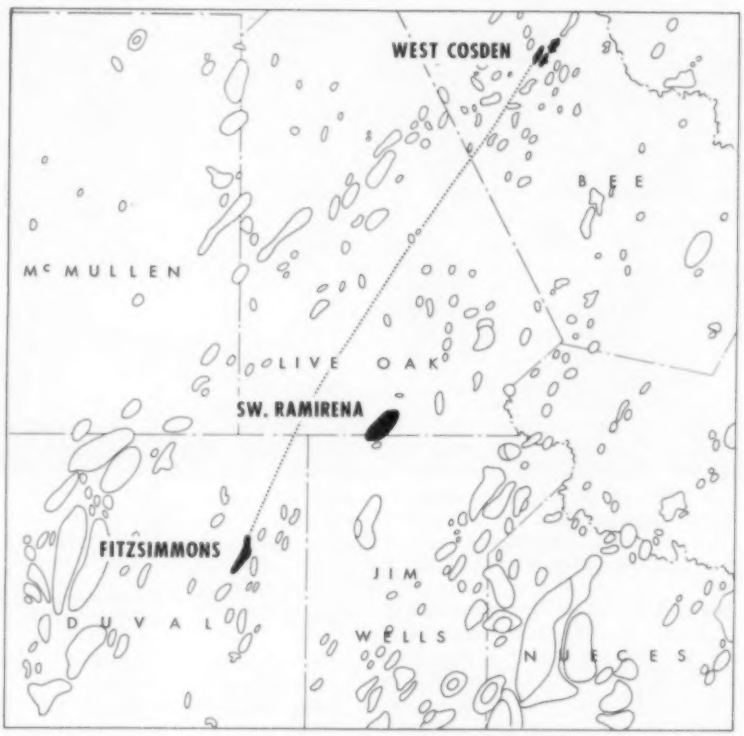
Further investigation disclosed oil shows in Richardson 1 Mew well (A on Fig. 2) located in the graben west of Fitzsimmons field. Location of this test is on the fault trace just southwest of the triangle of acreage. Sand present in the interval 3,436 to 3,566 ft. in the Richardson well contained an oil show. In a 15-minute drill-stem test from 3,470 to 3,566 ft. through ¼ and ⅜-in. chokes, the tool slipped to 3,482 ft.

Maximum working pressure was 8 lb. and recovery was 220 ft. of mud cut with oil. An electric log was not run on this well, but a plotted driller's log indicated the bottom 7 ft. of tested section to be the upper Hockley sand, which is blanket in the area.

The Richardson well was drilled to a total depth of 4,336 ft. and plugged as a dry hole. Correlation of the driller's log indicated the Pettus to be faulted out. Using an estimated Pettus sand top from the driller's log and several estimated downthrown Pettus points from electric logs on wells in Fitzsimmons field, it appeared that a closed structure could exist in the graben area. This theory was supported by the oil test in the Richardson well from a blanket sand.

Fitzsimmons field production was established in two formations, the Pettus, which had oil in four stringer sands, and the Hockley, which had gas in one sand. Cumulative oil production for the field was 5,050,022 bbl. as of January 1957, and present annual production is about 63,000 bbl.

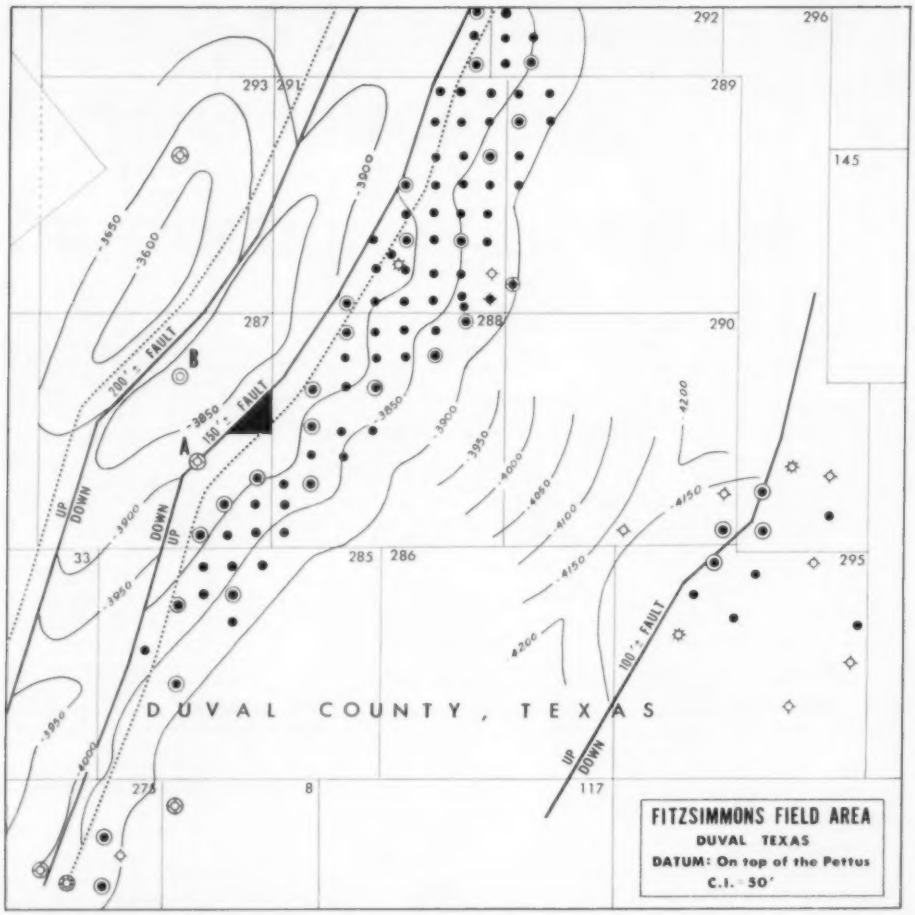
The Pettus sand was assumed to be the primary objective of the graben prospect, since it was the principal producing sand across the fault in Fitzsimmons field. To this date the Pettus is not producing in Johns field. Apparently there is no effective closure at Pettus depth.



JOHNS HOCKLEY field lies in northeastern Duval County, Texas, 11 miles due south of the junction of Duval, McMullen, and Live Oak counties. The dashed line on the map above traces the regional strike of the Hockley formation. Johns field is at the southwest end of this line and West Cosden field is at the northeast end. Locally, Johns field adjoins Fitzsimmons field to the east, and Bridwell field to the southwest. Southwest Ramerina and West Cosden fields produce from graben structures similar to Johns field. The author, who studied this area intensely before pinpointing the Johns field discovery well, is a Corpus Christi engineer who has been employed by the Chicago Corp., Seaboard Oil Co. of Delaware, F. William Carr, was president of Coastal Trend Oil & Gas Corp., and is presently with A. C. Sien, Jr.

The "Hard Sell"

Considerable difficulty was encountered in selling the Johns field prospect. I submitted it to a number of independents until finally C. C. Winn agreed to drill it.



THE OUTER PAIR of heavy dashed lines represent fault traces at Hockley depth; the inside lines are fault traces for the Pettus. Fig. 2.

The discovery well in Johns field was drilled at a location near the center of the graben and opposite the central part of the Fitzsimmons field. The location is at B on Fig. 2. Originally I had picked a location which offset Sun Oil Co. and H. J. Porter.

Since neither acreage nor dry hole support could be gained from these offset operators, the location was changed.

The discovery well created a wild scramble for additional acreage which was available. Apparently some people were extremely anxious to obtain our drill-stem test data for one person was apprehended in the test company's office searching for our test records. Fortunately we were able to acquire all the open acreage we desired.

Reservoir Data

Core and test results in the discovery well indicated two Hockley oil sands and five probable gas sands above and below the Hockley (Fig. 3). Johns field now produces oil from a depth of about 3,500 ft. from the upper and lower Hockley which appears to be one sand body on the electrical log. These two sands are at the bottom of Fig. 3. The upper Hockley is approximately 25 ft. thick and is a very fine-grained, medium-porous gray sand. The lower Hockley is approximately 35 ft. thick and is a coarse-grained, highly porous gray sand. The two sands are separated by 1 to 3 ft. of sandstone which is present throughout the area.

The upper Hockley has an average of 1,500 bbl. per acre-foot of oil in place, with an average mobile reserve of 1,000 bbl. per acre-foot, estimated from core analysis. The lower Hockley has an average of 1,900 bbl. per acre-foot of oil in place with an average mobile reserve of 1,200 bbl. per acre-foot.

The upper sand has an average permeability of 200 md. and porosity of 33%. The lower sand has an average permeability of 1,100 md. and porosity of 37%.

Several samples from one well in the lower sand exceeded the theoretical maximum porosity of 43% and caused the core analyst to recheck his instruments before tabulating the results.

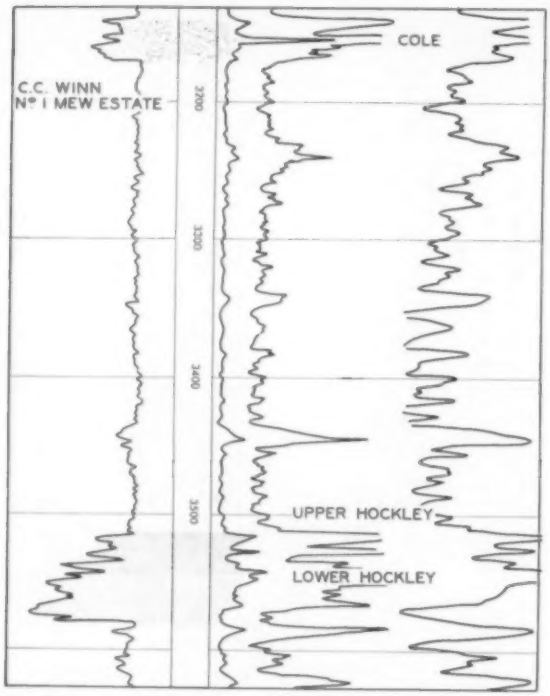
Both Hockley sands have a gas cap, gas in solution, and, we hope, an effective water drive. The estimated gas-oil contact for the upper Hockley is —3,109 and the oil-water contact is —3,144 (a 35-ft. oil column).

The lower Hockley gas-oil contact is —3,122 and the oil-water contact is —3,145 (a 23-ft. oil column).

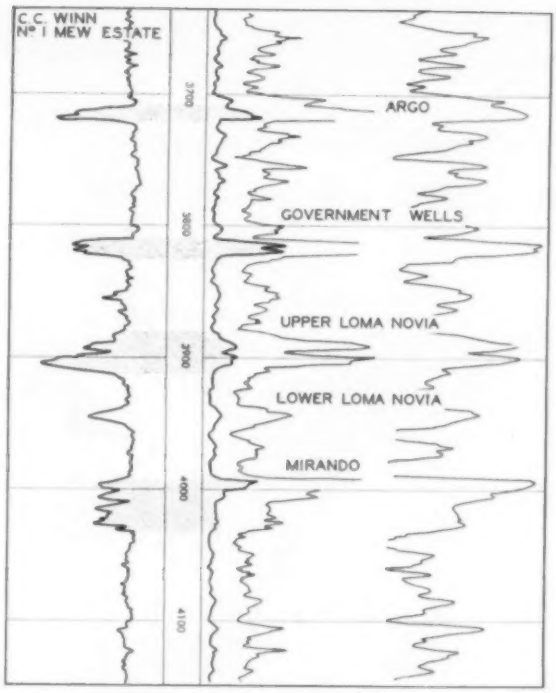
Average bottom-hole flowing pressure for the Hockley zone is 1,050 lb. and bottom-hole shut-in pressure is 1,350 lb. Gas-oil ratios range from 250 through 550 to 1.

The Mirando, upper Loma Novia, Government Wells, Argo, Cole, and several basal Frio sands are gas productive and range in depth from 2,100 to 4,100 ft. The Mirando, upper Loma Novia, Government Wells, and Argo sands on Fig. 4 are as they appeared in the discovery well.

Mobile oil reserve for the entire



TESTS indicate two Hockley oil sands and five probable gas sands above and below the Hockley. Fig. 3.



THE MIRANDO, upper Loma Novia, Government Wells, and Argo sands are gas productive. Fig. 4.

field should be approximately 12 million barrels.

Cumulative production from discovery in August 1956 through December 1957 was 298,161 bbl. The productive width of the field at Hockley depth is approximately 2,000 ft. and the length is approximately 3½ miles.

By February 17, this year, there were 46 completed wells, 45 oil wells, and 1 gas well. Fig. 5 is an up-to-date map of Johns field contoured on top of the upper Hockley. The southwest end of the field is delineated by dry holes which indicate a tilted water table.

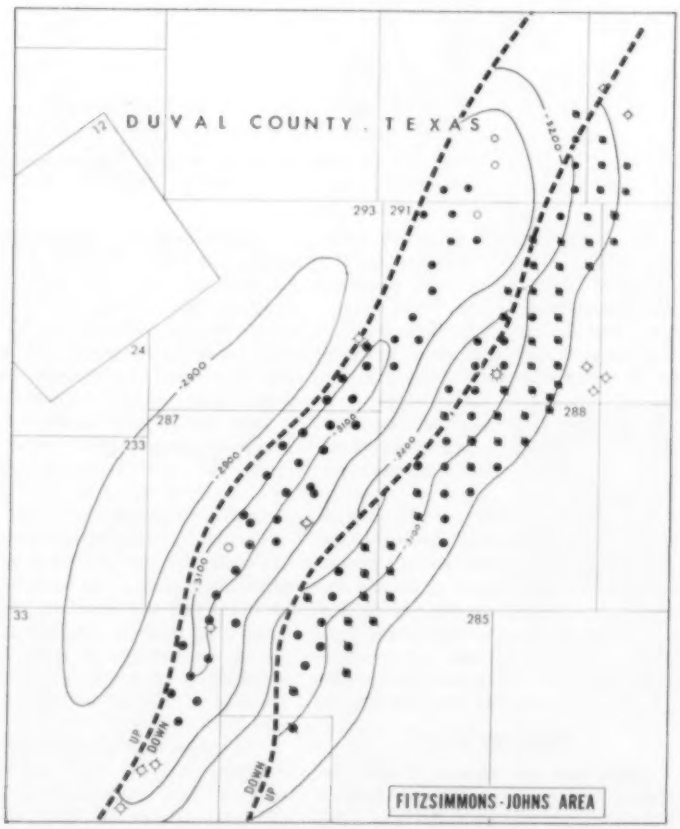
The oil-water contact in the two dry holes at the southwestern extremity of the field is higher than the average contact in the field and there is no indication of fault separation. Also, the northeast end of the field has a lower oil-water contact.

Outlet

Sinclair Refining Co. markets the crude oil from the Johns field and their current price is $3.27 per barrel. Coastal States Gas Producing Co. has contracted for the gas at 12.2 cents per thousand cubic feet and is now building a line through the field.

Acknowledgments

I would like to thank Ernie Mulle, geologist with the La Gloria Corp., for his assistance in the preparation of this paper.



DRY HOLES in southwest end of Johns field indicate a tilted water table. Fig. 5.

In the Buckeye State . . .

Completions falter, but Ohio production is boosted

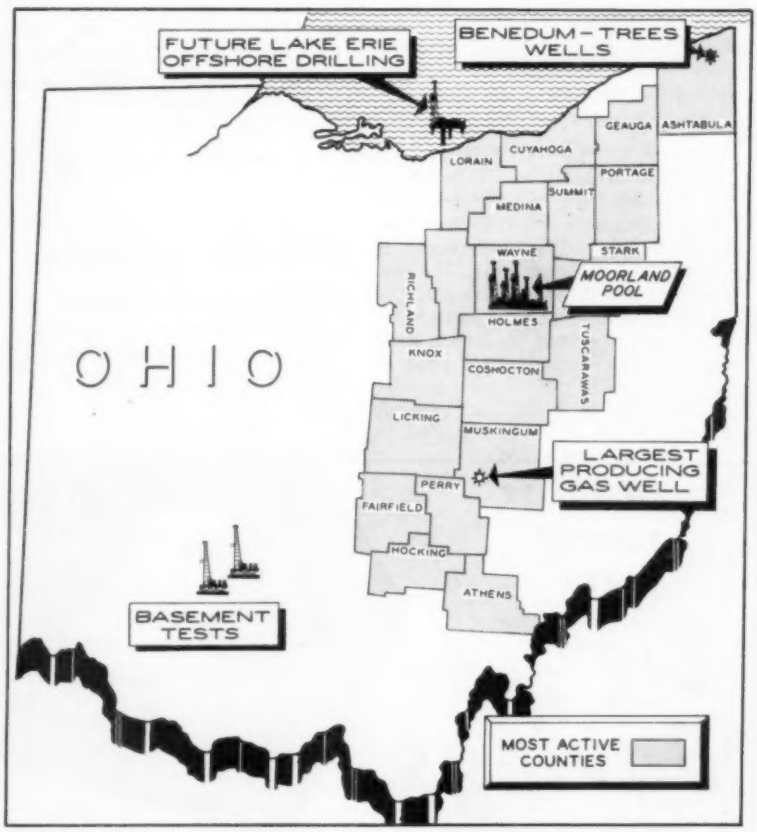
BY GEORGE G. SHEARROW
Ohio Geological Survey

THE MARKED INCREASE in production of approximately 800,000 bbl. of oil and 534 M.M.c.f. of gas, greatly overshadows the 9% decline in the total number of wells drilled during the year.

Total production amounted to 5,556,000 bbl. of oil and 32,261 M.M.c.f. of gas. The significant increase in the total number of successful completions has caused the dry-hole percentage to drop to 25.7%.

Most of this success is due to the improved logging and completion methods being adapted to Ohio's producing areas. In 1950, before fracturing was first introduced, the dry-hole percentage for all wells was 42%. Forty per cent of all Clinton wells drilled were dry.

This year the dry-hole percentage of wells drilled to the Clinton sand is 16.5%. Fifty-five per cent of the wells drilled were drilled to the Clinton sand.



Development

Of the 88 counties within the state, 47 had tests drilled within their boundaries during the year. The more active counties were Coshocton, 117 completions; Licking, 103; Ashland, 101; Wayne, 90; and Muskingum, 73. With the exception of Ashland, where Berea wells predominate, most wells completed in these counties were Clinton sand wells.

Of the 1,041 wells drilled, 199 were gas, 289 were oil, 285 were combination, and 268 were dry. Total initial production was 336,749 M.c.f. of gas and 47,814 bbl. of oil with 2,374,969 ft. of hole drilled.

Clinton sand tests totaled 576 of which 101 were gas, 133 were oil, 247 were combination, and 95 were dry. Total initial production from the Clinton amounted to 299,227 M.c.f. of gas and 46,305 bbl. of oil for an average initial production per well of 622 M.c.f. of gas and 96 bbl. of oil. The footage drilled was 1,880,468 ft., averaging 3,265 ft. per well.

Second in the number of completions was the first Berea sand. One hundred seventy-four wells were drilled to this horizon of which 14 were gas, 85 were oil, 9 were combination, and 66 were dry. For the 108 successful completions, initial production discovered was 730 M.c.f. of gas and 106 bbl. of oil. The average initial production for the 62.1% of successful tests was 7 M.c.f. of gas and 7 bbl. of oil.

Following the first Berea in number of completions was the second Berea. Included with these statistics are the completions in Tuscarawas County called second Berea by the driller but believed by the writer to be Cussewago sand wells. A total of 86 wells were drilled to the two sands, of which 28 were gas, 23 were oil, 20 were combination, and 15 were dry. Initial production was 11,963 M.c.f. of gas and 478 bbl. of oil, averaging for the 82.6% successful tests, 168 M.c.f. of gas and 7 bbl. of oil.

The largest gas well reported for 1957 was Devonian Gas & Oil Co.'s 1 Arthur Rankin located in Section 4, Hopewell Township, Muskingum County. The Clinton sands, found at 3,273-76 ft. and 3,288-91 ft., produced 1,980 M.c.f. of gas natural. After fracture the well was gaged at 10 M.M.c.f. of gas with a rock pressure of 875 lb. in 8 hours.

Although several large oil wells were reported in Muskingum County, Moorland pool in Wayne County rep-

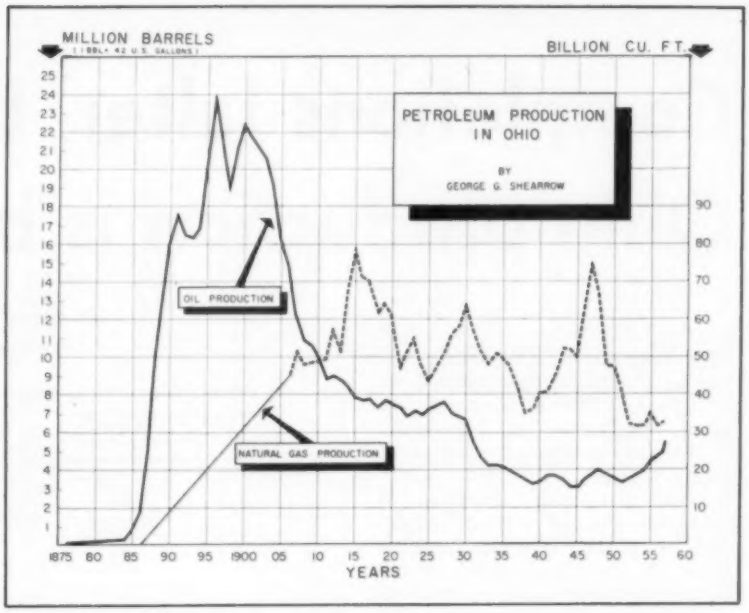
resents one of the most outstanding developments in recent years. The discovery well, Smith Petroleum Co.'s 1 Baker Community was completed in August 1956 at 700 bbl. of oil and 1,555 M.c.f. of gas with 1,100 lb. In this well the Clinton sands were recorded at 3,492-99 ft. and 3,505-36 ft.

Development through 1957 has covered approximately 2,000 acres. The pool is 3 miles long, north and south, and approximately 1 mile wide. Thirty-four wells have been successful and three were failures. Initial production after fracture ranges from 100 to over 1,000 bbl. with varying amounts of gas up to 1,600 M.c.f. Nineteen of the completions reported wells of 250 bbl. or over. Several wells were reported to have paid out in less than 6 months' time.

Exploration Drilling

Six rank wildcat wells, including one completed too late for the 1956 report, tested sediments from the Clinton to the Precambrian and ranged in depth from 1,285 to 4,708 ft. The two basement tests drilled by Kewanee Oil Co. in Fayette County, in southwestern Ohio, penetrated the entire sedimentary rock sequence. No production was found.

The 1 N. J. Monk and 1 Sarah Porter located in Morrow and Wood counties bottomed in the Upper Cambrian. Both reported shows of oil and gas but were not successfully completed.



RECENT UPTURN in Ohio's oil production continues despite lagging discoveries.

Two Trenton tests, the 1 Don Ingle in Miami County and the 1 George Lawhead, located in Shelby County, were also dry holes.

Probably the most publicized wells of the year are those completed by Benedum-Trees Oil Co. in Ashtabula County. The 1 Thomas J. Scribner and the 1 Henry Fox are located in Monroe Township, 8 to 10 miles south of Conneaut gas pool. Although news releases reported initial production figures for the 1 Scribner as high as 7,000 bbl., a more reasonable figure would be around 150 to 200 bbl. for the first 24-hour period after the fracture oil was recovered.

It is estimated that these two wells will settle to 15 to 40 bbl. daily if they follow the same production pattern as other Clinton wells in the state. The discovery of these wells may indicate a possible second Clinton shoreline trend.

The relationship of these wells to Conneaut pool in Ashtabula County, Madison-Lake pool of Lake County, Aurora and Ravenna pools of Portage County, and Canton pool of Stark County tend to substantiate this contention. Although tests have been drilled in this area in the past very little drilling has taken place since the Hydrofrac method has rejuvenated Ohio's oil and gas industry.

Storage, core test, and brine wells . . . Wells drilled for gas storage in depleted gas pools totaled 102. A large percentage of these wells were drilled in the old Allensville gas pool in Vinton County. In the 16 storage

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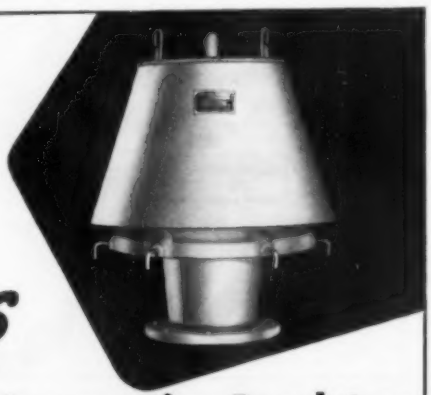

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areas in the state over 2,000 wells have been reconditioned and drilled for the purpose of gas storage.

Six core tests were drilled in Muskingum and Butler counties to check the feasibility of storing liquid-petroleum products in mined caverns in impervious shale and limestone formations. Seven others were drilled for the purpose of checking porosity and permeability in potential water-flood areas in Monroe and Washington counties. The remaining four tests were drilled to recover brine in Licking County and salt in Cuyahoga County.

Drilled deeper and secondary recovery wells . . . From the total of 29 wells deepened, 3,901 M.c.f. of gas and 675 bbl. of oil were discovered. Two-thirds of these were deepened to the Berea and Clinton sands. Total footage of drilled deeper wells is 20,612 ft.

Water-flooding permits issued by the Division of Mines totaled four. Twenty-nine input wells and 58 oil wells were drilled during the year. The most active area is in Chatham Township, Medina County. Here there are 651 operative oil wells and 441 operative input wells in the Berea. Ashland County promises to be another successful Berea flood area; however, less than 100 secondary-recovery wells are now active in this county. The Berea is also being flooded in Lorain County.

On a much smaller scale the Macksburg 500 in Noble County, the Keener in Monroe County, the Oriskany in Muskingum County, the Newburg in Fairfield County, the Clinton in Perry County, and the Trenton in Hancock County are being flooded. Results of these floods have not been reported.

Future Expectations

Leasing of the mineral rights under Lake Erie did not become a reality last year as expected. With Pennsylvania leading the way by leasing two blocks, it is possible that this will be an incentive for Ohio to follow. Regulations and procedures are, at this date, receiving their final criticism. The offering date to public release has not been set but should fall within the next 12 months.

The Kewanee block in southwestern Ohio was tested by two wells this past year. Further seismic work will be done in this area and probably will be followed by additional drilling.

Drilling to the Clinton sand should continue at the same rate in east central Ohio. Northeastern Ohio should receive additional testing due to the discovery of the wells in Ashtabula County. Many potential Clinton areas still remain to be tested.

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California drillers busy in Los Angeles County

DRILLING was on the upswing in the Saugus-Newhall-Placerita area of Los Angeles County.

In the Placerita field area, Lago Vista Oil Co. had reached total depth at 3,010 ft. with a wildcat 1 mile north of Placerita production. Lago Vista reported it has suspended operations at that depth temporarily.

About ½ mile northeast of Lago Vista's test, Langlois Brothers was running dipmeter tests after moving off the rig on a 2,201-ft. wildcat in SW NE 20-4n-15w northeast of Placerita.

Both the Lago Vista and Langlois wildcats are in an area that dates production back to 1920 in the immediate vicinity and to 1875 in surrounding fields in the Newhall area.

West of these two wildcats about 2 miles, four wildcats were drilling in the Saugus area.

Edward T. Lustgarten was swabbing a 2,993-ft. test in SW SE 14-4n-16w. One mile west of Lustgarten's wildcat, Union Oil Co. was drilling ahead at 9,263 ft. on B-2 on NL&F in NE SW 15-4n-16w.

In NW NE 25-4n-16w, Union was coring at 4,650 ft. on 1 Bermite. This wildcat is located a little more than 1 mile west of Placerita production.

The Texas Co. was also involved in this activity with a wildcat drilling ahead below 1,183 ft. in SW SE 22-4n-16w.

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North Tejon Drilling Increases

Reserve Oil & Gas Co. has staked location for a northeasterly offset to Richfield Oil Corp.'s new pool discovery 1 mile west of Reserve's main area activity in the North Tejon field.

Addition of a rig here will give the field four active drilling projects aimed at the prolific Vedder zone. The other three are:

. . . Reserve was drilling below 14,260 ft. on a deep Eocene test about ½ mile south of the North Tejon field discovery well.

. . . About ¼ mile east of the Eocene test, Reserve was drilling ahead below 6,731 ft. on fifth hole to be drilled in the field. This test, 382 "BW-T," is in the immediate vicinity of the two other producers.

. . . Richfield Oil was drilling below 4,556 ft. on 61-24 KCL "I," a westerly offset to its recent Vedder pool discovery 1 mile west of the main North Tejon area.

Conoco Hits New Pool at San Miguelito

Continental Oil Co. went back into an old well on the west edge of San Miguelito field in Ventura County to hit a new pool discovery on its 2,542-acre Grubb lease.

The operator deepened 39-2 Grubb, originally drilled to 8,549 ft. in 1945, to 11,050 ft. and recompleted it in an interval at 10,789-11,050 ft. It was brought in flowing 602 bbl. daily through a 40/64-in. choke. Gravity is 25.8° with 4.7% cut.

Standard Misses With First El Rio Extension

Standard Oil Co. of California, Western Operations, Inc., missed with its first attempt to extend production in El Rio field north of Oxnard in Ventura County.

The operator moved ¼ mile south of the discovery and drilled an 11,592-ft. hole which failed to find the Oligocene age Sespe pool.

Standard has conductor pipe set in another extension try east of the discovery.

Washington Well Reaches Total Depth

J. W. Tanner, operator, had reached total depth at 8,015 ft. and was running an electric log in 1 Sylvester Gunther, a wildcat in the Chahalis area of Lewis County, Washington.

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Third try pays off in northwestern Alberta

NORTHWESTERN Alberta's Berland River region is western Canada's newest gas-discovery area.

Shell Oil Co. and British American Oil Co. found gas in the Devonian D3 reef below the 12,000-ft. level. High flow rates were reported on three separate drill-stem tests. After the last test, however, the operators had circulation problems.

The well is British American-Shell A-8-4-5923 Berland River, LSD 8, 4-59-23w5. The drill-stem tests run to date at the well cover a total of 128 ft. of which 121 ft. is net pay. The closest previous production to this new discovery is at Pine Creek field, 25 miles to the east, while the Kaybob area is 25 miles northeast and Iosegun 13 miles beyond that.

The first drill-stem test at the well covered the top 30 ft. of pay. Gas flowed at the daily rate of 12,300 M.c.f. The next test, covering 30 ft., got 9 M.M.c.f. per day, later falling to 5,500 M.c.f. per day. The last test got 13,200 M.c.f. per day, leveling off to 10,600 M.c.f. daily at the end of the test.

This is the team's third attempt in this region, and the first success. The D3 reef tapped at the Berland River well is the deepest gas-bearing reef yet found in Alberta.

New gasser born in Wyoming's Dakota

THE THIRD gas producer in Wyoming's North Baxter basin area, Sweetwater County, was completed by Mountain Fuel Supply Co. This Green River basin well, 1 Laurunen, NW NE SW 24-20n-104w, flowed 6,800 M.c.f. of gas daily from Dakota perforations at 3,599-3,603 and 3,606-10 ft.

This is the third well in the field which was opened in 1956 at 1 Union Pacific, NW SE SE 23-20n-104w. That well flowed 7 M.M.c.f. per day from Dakota. The confirmation well, 1 Featherstone, E½ NW NW 24-20n-104w, flowed 824 M.c.f. per day from the Dakota.

North Baxter basin field, to the south of Mountain Fuel's gas production, is separated by several dry holes from this new gas development.

Wyoming's Big Piney Adds Prolific Gas Wells

Big Piney field in Wyoming's Green River basin continues to add prolific gas wells.

The latest is Gulf Oil Corp.'s 9 Tresner-State in C NE NE 36-29n-113w, at the southern end of the field.

Gas flow was 22,100 M.c.f. per day through open 2-in. tubing from perforations at 2,684-2,862 ft.

Kentucky Gets Strike

TWO MILES SOUTH of Puncheon Creek pool in western Breathitt County, Prather et al have either extended that production or opened a new pool at their 1 Sam Combs located at the junction of Highway 30 and Middle Fork of Kentucky River.

Topping Corniferous pay at 1,579 ft., test logged pay to 1,587 ft. total depth, where at last report, well was flowing by heads at the rate of 100 bbl. per day.

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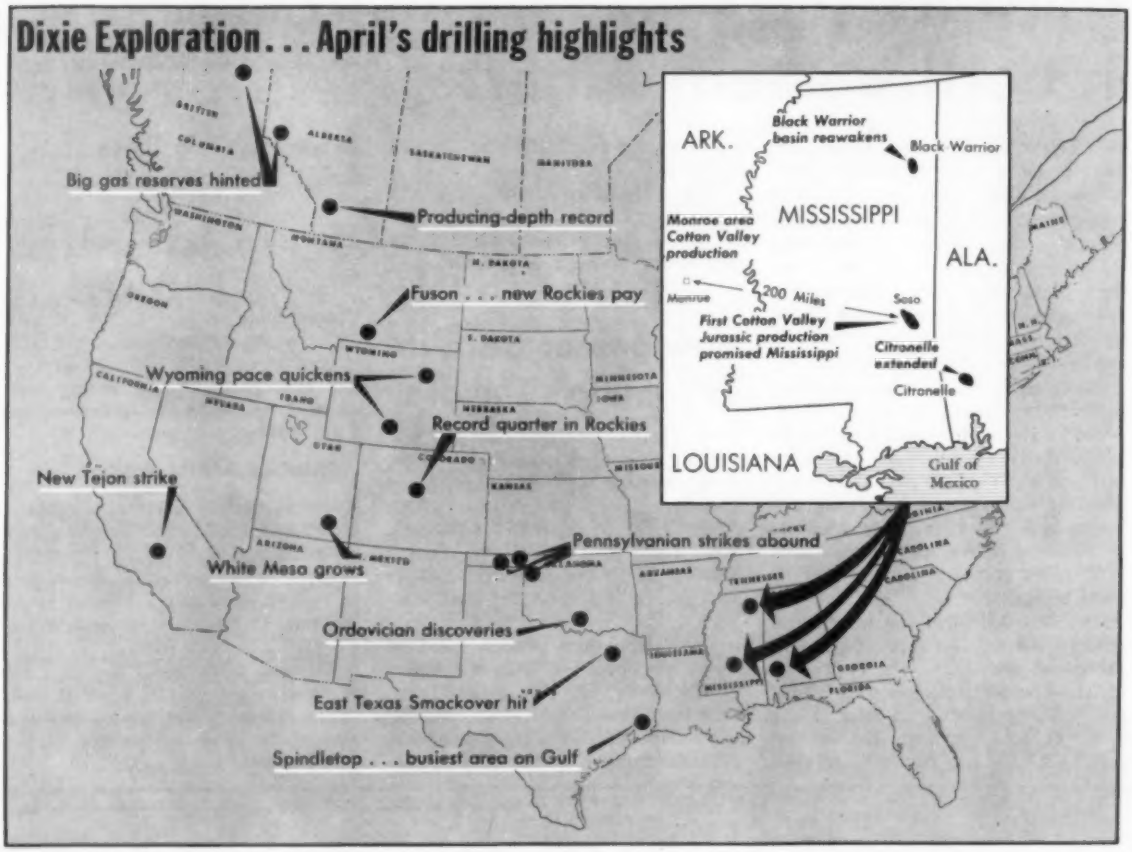


Depth record in Alberta, big gas reserves in British Columbia, record completions in the Rockies, but . . .

Southeast action sets the pace

BY JOHN C. McCASLIN
District Editor

RECORD-BREAKING first Cotton Valley-Jurassic oil in Mississippi, an extension to Citronelle, and the stir of new activity in the Black Warrior basin gave exploration in the deep south the nod over regional developments in April.

A first . . . Gulf's deep Soso Cotton Valley discovery flowed at the daily rate of 528 bbl. plus 15% basic sediment and water from perforations at 15,247-56 ft. on drill-stem test.

- Successful completion in the Cotton Valley has opened first such production in the state.
- Nearest Cotton Valley production is nearly 200 miles northwest in the Monroe area of North Louisiana.
- Completion at 15,255-56 ft. at Gulf's well has set a new producing-depth record for Mississippi. The former record is at a nonproducing well in Tinsley field, Yazoo County, at 14,427 ft. in the Smackover.
- Total depth at the discovery is 19,040 ft., making it Mississippi's second-deepest well.
- Tests in the Hosston-Lower Cretaceous promise a second pay zone in the well—Hosston production would be the first at Soso, giving the field six pay horizons containing several sands.

The deep-drilling campaign in the lower Mississippi embayment really began in earnest at Soso in 1953. Lower Cretaceous finds began popping up at Bolton, Pistol Ridge, Ansley, Taylorsville, Valley Park, Raleigh, Martinville, Gitano, Diamond, and Dexter.

Success at Gulf's Cotton Valley well at Soso will demand a second look into the Lower Cretaceous fields of

Mississippi—we can look for a spirited trek into the pre-Cretaceous rocks of southern Mississippi in the next few years.

A revival . . . After a 4-year lull, the hard-to-crack and disappointing Black Warrior basin of northeastern Mississippi and northwestern Alabama is back on the exploratory scene.

Shell Oil Co. brought life back into this Paleozoic basin at its 1 Jarrett et al. in Clay County, 1 mile north of old Siloam gas field (now abandoned). Shell's strike flowed 2,970 M.c.f. of gas per day plus 16 bbl. of distillate from perforations in the Chester-Mississippian Carter sand at 8,536-67 and 8,603-20 ft.

Previous exploration in the Black Warrior basin has been relatively unsuccessful. After a series of dry holes, operators moved their thoughts elsewhere. Shell's new strike may well return the drill to this Dixie province of mystery.

A stretch . . . Alabama's famed Lower Cretaceous Citronelle field north of Mobile grew 1½ miles to the southeast at a Magnolia Petroleum Co. well, 1-A School Land. The Rodessa well made 116 bbl. of oil daily on a Kobe pump. This new extension stretches the field 6 miles from its most northerly well.

The Regional Story

Big new gas reserves in western Canada, drilling records in the Rockies, a fast-moving play near Spindletop in Texas, new Smackover production in East Texas, new success in the Tejon area of California, Ordovician and Pennsylvanian discoveries in Oklahoma, an extension to the Paradox basin oil ocean, a brand new pay for the Rockies, and fired-up enthusiasm in Wyoming's Green River and Powder River basins rounded out a wildcat month of high caliber.

The gas year . . . This appears to be the gas year for western Canada. Huge new reservoirs were opened in April in the Grande Prairie region of western Alberta, and in the far north country of British Columbia at Fort Nelson.

Triad Oil Co. brought in three gas strikes in the Grande Prairie region—at Haglund, Big Mountain Creek, and Grovedale. Far to the northwest near Fort Nelson a vast gas area that could rival Fort St. John field is shaping up. The latest strike at Fort Nelson is a Gulf States et al. well at Clarke Lake. Production is from the Slave Point-Devonian. Other producers here are at Klua Creek, Prophet River, and at Fort Nelson.

Records set . . . Rocky Mountain operators just closed out the best first quarter in the drilling history of the region. Successful wildcats and total wells completed both set new records. Exploration throughout the province remains strong—particular success was noted in Wyoming and Utah.

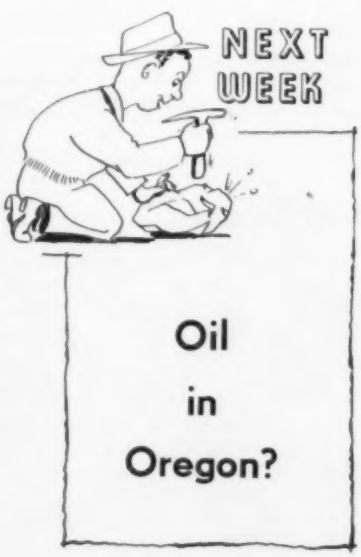
Wyoming had two significant happenings in April. A new Mesaverde oil discovery northwest of Dead Horse Creek placed further fuel on the heated Powder River drilling campaign. The well is Davis Oil Co. 1 Federal. It flowed 20 bbl. per hour.

Another test is planned east of El Paso Natural Gas Co.'s big Desert Springs gas strike in the Green River basin. The No. 2 well at Desert Springs itself flowed gas from the Lewis-Upper Cretaceous, opening a second pay zone in this Mesaverde field.

Utah's Paradox basin gained a good extension discovery at Continental Oil Co. 1 Navajo-C on the southeast side of White Mesa field. The Pennsylvanian well flowed 50 bbl. per hour.

California Tejon . . . The North Tejon area is proving to be one of the busiest spots on the West Coast with a significant new fault-block discovery and a successful extension to the field. Richfield's 81-24 KCL, 1¼ miles west of North Tejon field, flowed 4,000 bbl. per day from the Vedder sand; the southeast extension, Reserve Oil & Gas Co. 318-17 Standard-Butler-Wehr-SP, made 3,120 bbl. per day from the Vedder.

Sooners go south . . . Both deep and shallow discoveries in extreme southern Oklahoma have shifted exploratory interest into Love, Marshall, and Bryan counties.



Sinclair Oil & Gas Co. 1 Tucker is a tentative Ordovician strike in the Southwest Enville area of Love County. Sinclair's 1 Anderson near Durant in Bryan County is a possible Ordovician hit in a virgin wildcat area at the east end of the Ardmore-Marietta basin. Shell has two shallow strikes in the Marshall County area, one in the Pennsylvanian Des Moines, the other in the Pennsylvanian Deese.

Northern Anadarko . . . Three northwestern Oklahoma discoveries fattened Pennsylvanian coffers in April.

The Texas Co. got 532 bbl. of oil daily from the Kansas City-Pennsylvanian at its 1 Barby in southern Beaver County—right in the middle of a large nonproductive area of the county. Beaver County has another important strike at Republic Natural Gas Co.'s 1 Nine southwest of the fast-growing Highland-Laverne district.

The well made 25 M.M.c.f. of gas daily from the Hoover-Pennsylvanian. In Ellis County, Pan American Petroleum Corp. 1 Schoenhals opened the county's fourth producing area with production from the Morrow at a record depth of 10,745-47 ft. This gas-distillate well is the deepest Morrow production anywhere.

Old area, new look . . . Within a 30-mile radius of Spindletop, birthplace of Gulf Coast oil, wildcatters have opened six new fields this year. This southeastern Texas area (Jefferson and Chambers counties) is the busiest on the Gulf Coast.

Smackover revival? . . . The off and on Smackover play in East Texas gained its first strike in some time at Grelling Estate 1 Bassham in northeastern Hopkins County.

A new pay . . . The Fuson of Lower Cretaceous age is a new pay zone for the Rocky Mountains. The discovery well is Carter Oil Co. and Mobil Producing Co. 1 Wheatley-Government in the Belfry area of Carbon County, Montana.

This northern Big Horn basin well flowed 1,121 M.c.f. of gas per day and 196 bbl. of condensate. The Fuson is a member of the Cloverly group, lying between the Lakota and Dakota.

New Canada record . . . Canada has a new producing-depth record at 10,676 ft. The well is Bailey-Selburn's Willow Creek strike 60 miles south of Calgary in the Foothills belt. Production is from Dalhousie zone of basal Blairmore-Cretaceous. Oil flowed at the hourly rate of 5 bbl.

North of the Grand Canyon . . .

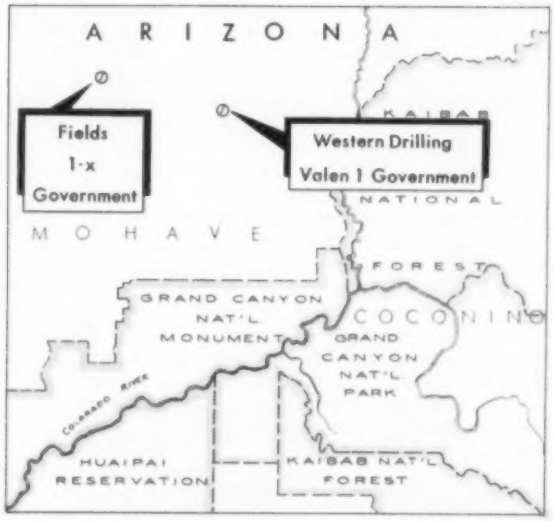
Drillers test remote Arizona area

AN ARIZONA operator reports pump installation at his 1-X Government wildcat in SW SW 17-38n-7w, Mohave County. The R. A. Fields wildcat is at total depth 1,151 ft. Recoveries are reportedly noncommercial, but three more tests are planned in this area known as the South Antelope structure.

Top of the Coconino is 1,100 ft.; casing is set at 700 ft.

In the same county Western Drilling Co.-Valen Oil & Gas Co. 1 Government, NW SE 31-38n-5w, is drilling at 4,270 ft. A sample of the Devonian at 3,450 ft. reportedly had some fluorescene. This Mohave wildcat is slated as a granite test.

Location of these wildcats is in remote country north of the Grand Canyon of the Colorado River.



TWO desert wildcats are under way in Arizona's Mohave County, north of the Grand Canyon in the northwestern part of the state.

Oklahoma's deep dig pays off

THE DEEP AND PROLIFIC Ordovician campaign in Oklahoma's Knox field gained an important southeast extension discovery. It is Gulf Oil Corp.'s 1 McKinney Unit in SE SE NW 24-2n-5w, Stephens County.

Gulf is taking open flow tests at this new addition to the deepest producing area in Oklahoma. Potential at the well is expected to be about 800 bbl. of distillate per day and 20 M.M.c.f. of gas.

Tests at 15,390-15,753 ft. in the Ordovician got 49 bbl. of distillate in 1 hour. On 11/64-in. choke the well flowed 4,060 M.c.f. of gas per day and 108 bbl. of distillate per million; on 1½-in. choke it flowed 5,550 M.c.f. per day and 99 bbl. distillate per million.

OKLAHOMA'S ultra-deep Knox Ordovician field in Grady and Stephens counties gained a long southeast extension at Gulf Oil Corp. 1 McKinney Unit.

Action in Ohio . . . and Texas

The successful closing-in of their large gasser in Moreland pool was announced by Ohio Fuel Gas Co.

Five-inch casing was snubbed into the 7-in. casing and the annular space between the casings packed off. The well on 1 R. J. Dial, Section 5, Franklin Township, Wayne County, topped the Newburg sand at 3,052 ft. and was drilled into the third pay at 3,070 ft.

The gage at that point was better than 20 M.M.c.f. natural.

Yegua sand is proving productive in the old Albercas area, in the northwestern corner of Southwest Texas' Jim Hogg County. Previous production has been from the Cole sand.

The Yegua discovery is by E. H. Smith of San Antonio at his 2 Major, located on the southeast side of the old producing area. The well pumps 46 bbl. of 37°-gravity oil per day from pay at 3,404-10 ft.

The area's Cole sand was productive at 2,200-ft. depths.

N. D. Fields Sprouting

NORTH DAKOTA'S Newburg and Rival fields are growing. Three more wells were added to Bottineau County's Newburg field and a southeast extension was completed in Burke County's Rival field.

The California Co. completed 2 Henry in Newburg field for 43 bbl. of oil per day on pump; the 3 Henry for 72 bbl. per day on pump, and is drilling at 1 Henry. The company also made location for 2 additional wells in this field. Amerada Petroleum Corp. completed 2 Henry for 81 bbl. of oil and 24 bbl. of water per day. Production in this field is from the Spearfish (Triassic) and the Charles (Mississippian). The 1955 field discovery now has 24 producers.

At Rival field Pan American Petroleum Corp. completed the 1 Nygaard for 155 bbl. per day. Production is on 15/64-in. choke from Nesson-Mississippian perforations at 6,070-98 ft. This well extends Rival field about ¾ mile to the southeast. The field has four producers and two extensions drilling, one more coring.

Indiana Field Extends

AN IMPORTANT northeast extension to a new producing area in Gibson County, Indiana, is Faith Oil Co. et al 1 Hutchinson, SE NE NW 4-3s-9w, 3 miles west of Somerville.

The Jackson well is pumping 205 bbl. of oil per day after fracture from 1,580-95 ft.

Of interest to oil finders:

A new map . . .

A COLORFUL new 6-year development map of the Permian basin is now available.

The map shows oil development in the Permian basin for the past 6 years. Pools discovered prior to December 31, 1951 are shown in black and each year's development through December 31, 1957, is shown in color.

Map data include: Main roads, pools outlined and named; and basins outlined in a separator color. Over-all size is 38 by 41 in. Scale is 1 in. to 41,000 ft. For information write to Midland Map Co., Box 1211, Midland, Tex.

A new book . . .

BLOCK DIAGRAMS AND OTHER GRAPHIC METHODS USED IN GEOLOGY AND GEOGRAPHY. By Armin Kohl Lobeck. Published by Emerson-Trussell Book Co., Amherst, Mass. 212 pp. $6.

This five-book volume deals with drawings and diagrams needed in physiography and geology.

The first part is devoted to the presentation of land features, showing the simple principles of perspective and the various land forms, including treatment of plains, plateaus, and dome, folded, block and complex mountains.

The second part of the book deals with use of graphic methods in solving geological problems involving the accurate determination of strike, dip, extent and location of outcrop, depth to known formations, and other data. The isometric type of perspective drawing is explained.

The third part of the book relates to special methods and the preparation of more elaborate types of diagrams.

The fourth part explains how sketches and diagrams represent by symbols the various kinds of land utilization. Brief consideration is also given to the making of line drawings from photographs and preparation of sketches in the field.

The fifth part of the book deals with crystal drawing.

And these AAPG abstracts . . .

Growth of Louisiana Salt Domes and Effect On Petroleum Accumulation

BY GORDON ATWATER
AND McLAIN J. FORMAN
Atwater, Cowan & Associates
New Orleans

DEEP DRILLING in southern Louisiana demonstrates that many salt domes exhibit variations in structural configuration which depart considerably from older concepts of salt-dome growth. Some of these structural abnormalities have played an important role in the accumulation of petroleum.

Detailed studies indicate that the growth of salt domes in this province has been characterized by intermittent periods of movement. Furthermore, evidence is now available to support the postulation that upward movement of salt from the deeply buried parent salt mass has often varied in location as well as time. It is important to recognize that the configuration of the present shallow piercement salt stock reflects the combined effects of various localized salt movements.

In some cases early movements of portions of the parent salt mass formed relatively low-relief structures in which early oil and gas accumulation took place. More recent growth of the present salt stock, peripherally located to the older structure and intrusion, has formed new traps of higher structural position into which the earlier accumulations of petroleum have migrated. Thus, the structures created by salt movements have been intermittently altered, and associated petroleum accumulations have been transient in nature.

In addition to those major shifts of loci of salt intrusion, movement of the salt within the present shallow piercement plug has not been uniform throughout the plug. This irregularity of upward flow is demonstrated by the different structural positions of major flank segments, local unconformities on restricted flank areas, shallow salt spines, and deep-seated shoulders on salt masses.

These intermittent shifts of upward movement within the salt stock in some cases have probably kept the petroleum accumulations around the dome in a game of musical chairs, constantly readjusting to positions of more favorable structural traps. The location of some of the present commercial accumulations represents only the result of the most recent readjustments.

Application of concepts herein developed regarding the nature of salt-dome growth should be considered in planning exploration programs around the flanks of piercement salt-dome structures, and may lead to reinvestigation of nearby areas previously condemned as occupying off-flank or synclinal positions.

This is an abstract of a paper presented in Los Angeles, March 1958.

The Future Offshore And Onshore Oil of The Pacific Coast States

BY JOE B. HUDSON
Monterey Oil Co.,
Los Angeles

THE PACIFIC COAST states are currently producing a little less than 1 million barrels of oil per day, with about 7% being offshore oil. More than 50% of this total is coming from 10 giant fields.

These states have produced to date approximately 11 billion barrels total, with less than 5% coming from offshore. The present proved reserves are thought to be in the neighborhood of 4 billion barrels, or enough to last California about 10 years.

The basins and the more than 50 structures (only 1 of which has been drilled), that have been located offshore the State of California by geophysical and geological survey teams working in concert, have been studied. These teams have probably done a more thorough job of detailed surface, seismic, and coring exploration per square mile than has been conducted anywhere else in the world.

The seismic surveys conducted offshore the State of California are equivalent to approximately 150 crew-years of land work, and were done at an average cost per mile of $800, which is about six times the cost of comparable work done elsewhere in the

world. This is because the California Fish and Game Commission required black powder to be used in place of dynamite, and geologic conditions made it necessary for cross or "L" spreads to be shot.

The conclusion that one reaches, after a review of this vast amount of structural data, is that within the next decade or two California offshore will surely be producing a substantial amount of the state's total oil requirements, provided that our industry has laws, leases, and regulations to work under which will make this oil competitive in a world market.

This is an abstract of a paper presented in Los Angeles, March 1958.

Bone Springs hits production in N. M.

NEW BONE SPRINGS production was opened in Lea County, New Mexico at Sinclair Oil & Gas Co.'s 1 State-Lea 403.

The well flowed 179 bbl. of 34.2°-gravity oil in 9 hours through a 24/64-in. choke for a calculated potential of 477 bbl. daily. Production is from perforations in the Bone Springs at 8,504-14 ft.

The discovery, located in NW NW 22-18s-35e, is 1 mile west of Pennsylvanian production and 2½ miles northwest of a Devonian discovery in the South Vacuum unit.

Sinclair also completed 3 Harris, NW NE 18-12s-38e, in Gladiola field, Lea County. The well flowed 330 bbl. of 44.1°-gravity oil in 24 hours through a 24/64-in. choke from Devonian perforations at 11,954-68 ft.

Second Well Confirms Texas' Cano Extension

BETTIS & SHEPHERD, of Dallas, are confirming their extension last September of Mexico's Cano field across the Rio Grande into Texas' Hidalgo County.

Their latest well, second for the Texas extension area, also opens two new Frio sands, one perforated at 7,127-33 ft. and the other at 6,698-6,720 ft.

Their initial well on the Texas side of the river is productive from a deeper Frio pay, perforated at 7,628-36 ft.

Production from all three sands is gas and condensate. The new well, 2 Ramey, is rated good for 17,100 M.c.f. of gas per day from its deeper pay, and 6,800 M.c.f. per day from its 6,700-ft. sand. Gravity of the condensate is 54.7° and 56.6°, respectively, from the two sands. Shut-in pressures are 2,843 and 2,783 psi., respectively.

The first well, 1 Ramey, has an open-flow potential rating of 4 M.M. c.f. per day. Liquid recovery is 54.1°-gravity condensate in the ratio of 141,400 cu. ft. per barrel. Shut-in pressure is 3,610 psi.

Louisiana deep well completed

THE recently opened Ramos field in eastern St. Mary Parish is joining the long list of South Louisiana fields with production below 15,000 ft.

The field's second well is completing in sand at 15,266-72 ft., where it tested 2,770 M.c.f. of gas per day through ⅛-in. choke. Condensate recovery was 32 bbl. per 1 M.M.c.f. Flowing pressure gaged 8,232 psi.

It is ½-mile west of the discovery well, completed last September with gas and condensate production from sand at 14,682-50 ft.

Both wells were drilled by British-American Oil Producing Co. The discovery well, 1 Intercoastal Shipyard, was drilled to 15,125 ft. The new well, 1 Whitney, has a total depth of 15,439 ft.

Location is about 5½ miles southeast of Morgan City at the eastern tip of the parish.

Eastern Michigan bags record gasser

STEPPED-UP EXPLORATION in eastern Michigan is expected to follow a record-volume natural-gas completion in St. Clair County.

Glen Mills 1 Baumgarten, W½ SE NW 22-4n-15e, Casco Township, gaged 24,600 M.c.f. of gas per day after a 5,000-gal. acid treatment to A-1 Salina dolomite pay. Well gaged 5,200 M.c.f. natural at total depth of 2,400 ft.

A-1 dolomite was logged at 2,348 ft. with first gas at 2,349 ft. Well showed steady increase to total depth. Gas well is located 800 ft. east of a 2,600-ft. Niagaran zone oil well drilled by Mills last year. Panhandle Eastern Pipe Line Co., major leaseholder in the district, drilled the Salina gas discovery 2 years ago in the same section.

There is strong evidence of a pinnacle reef condition in the area with much additional drilling necessary to determine the economic potential of the play.

Panhandle Eastern already has a gas transmission line into the field offering immediate gas market.

SETTING a new volume record, this natural-gas well has been completed in St. Clair County, Michigan.

Successful Wildcats

CALIFORNIA

Kern County: O. M. Slosson, 51 Tejon, SW SE 16-11n-18w, 232 BOPD, 33° gravity, 60% cut, 17/64-in. choke, perfs. 2,316-2,303 ft. and 2,298-50 ft., TD 2,713 ft. (New lower Miocene pool discovery ½ mile west of Tejon Hills field production.)

Richfield Oil Corp., 81-24 KCL "I," NE NE 24-11n-20w, 1,050 BOPD., 34.1° gravity, 20/64-in. choke, 0.2% cut, perfs. 9,165-9,557 ft., TD 9,559 ft. (New Vedder pool discovery 1 mile west of North Tejon field produtcion.)

Ventura County: Continental Oil Co., 39-2 Grubb, SE SE 23-3n-24w, 570 BOPD, ¾-in. choke, perfs. 10,789-11,050 ft., TD 11,050 ft. (New deeper pool discovery on west edge of San Miguelito field.)

ALBERTA

Ambassador-Sohio 1-4-40-23 Alix, LSD 1, 4-40-23w4. D1 gas discovery. TD 3,973 ft.

Triad-Pan American 3-26-66-7 Big Mountain Creek, LSD 3, 26-66-7w6. Permo-Penn gas discovery. TD 10,761 ft.

Hudson's Bay-Pan American-Fina 7-13-56-20 Beaver Creek, LSD 7, 13-56-20w5. D1 gas discovery. TD 12,295 ft.

SOUTHWEST TEXAS

Hidalgo County: Harry L. Martin et al 1 King, Tract 265, Los Ejidos de Reynosa Viejo Grant (½ mile northeast of La Joya). Absolute open-flow potential 32,000 M.c.f. daily, GLR 806 M.c.f. per barrel, 56.7°, shut-in TP 1,752 psi., perforations 4,262-70 ft. and 4,294-4,302 ft. (Frio-King sand). TD 6,286 ft. (New pay in Tabaso field.)

Pet Project Sewed Up

. . . by Ben F. Uhl, Jr., after becoming Conorada's top man. He disclaims credit for Tunisian exploration operation.

JUST A LITTLE more than a month after becoming top man at Conorada Petroleum Corp., Ben F. Uhl, Jr., could look back with satisfaction at one of his pet projects—all wrapped up.

Conorada was granted a permit to look for oil over almost 11,000 sq. miles of Tunisia (see page 88). The Tunisian operation has been a particular "baby" of Uhl's for months. It's fitting that the long negotiation leading to signing the final deal came after his promotion to president of Conorada.

Uhl is quick to disclaim credit for the successful negotiations.

"I've got a good man to handle that part of it," he says with a grin. William F. Penniman, one of his vice presidents, handles governmental relations and negotiations and is still in Tunisia. But, Uhl returned to his New York office after a quick trip to Tunis a few days before the signing ceremonies.

Heading up a company like Conorada is a complicated job. It's a far cry from the science of micropaleontology, once his primary field. Because Conorada is exclusively an exploration company operating outside the United States, there's a lot of evaluation of prospects involved in its work. Uhl, as a top research geologist, hits his stride in appraising the geology. But, because his company's operations are strictly foreign, the economic, political, and legal factors involved are just about as important as the geology. The new president is moving into this phase of the work with quiet confidence.

All this evaluation is only part of the job. All oil company presidents have bosses in their boards of directors. Uhl has three bosses. Conorada is owned jointly by Continental Oil Co., Ohio Oil Co., and Amerada Petroleum Corp.

Selling job . . . Once all the factors of a foreign oil prospect have been weighed from all the angles and it looks promising, the president of Conorada has the job of selling his proposal to all three parent companies. Uhl's not so optimistic he thinks he'll always bat 1,000. In the past only two of the companies have decided to take a piece of a concession pie that Conorada has been ready to slice. It's possible that all three, only one, or none of the parent companies will share Conorada's enthusiasm for a new prospect.

Under these circumstances a quiet sense of humor could be a prime asset for a Conorada executive. Uhl qualifies with a ready grin that has laced the corners of his eyes with a crinkle of crow's feet.

Tall and lean, Uhl has the appearance and the drawl of the proverbial Texan. He qualifies, too, with Dallas as his birthplace, but with a wry chuckle he'll tell you he left Dallas at the advanced age of 3 months.

Uhl, the son of a civil engineer usually on the move, comes naturally by the traveling he does today. He got his bachelor of science in geology at the University of Arkansas and then followed it up with a master's from the University of Oklahoma. Years later he did work at the University of California on a Ph.D., but like a lot of men busy with the more practical demands of a business life, he never finished the work on the doctorate.

Has experience . . . After leaving the University of Oklahoma in 1932—hardly the most promising time to storm the ramparts of the oil business—he spent 5 years with the Oklahoma Geological Survey. Those years are his only experience in "domestic oil." The next 19 years he spent in jobs where all the emphasis was on foreign oil or foreign operations, experience which fits him perfectly for his new position.

From 1939 to 1949, his home was Colombia working as a micropaleontologist and stratigrapher with affiliates of Standard Oil Co. of California and The Texas Co. Next he spent 4 years in Washington as a research geologist with the U. S. Bureau of Mines evaluating the geology and productive capacities of foreign countries for the Government.

January 1, 1954, he joined Conorada as research geologist working on detailed and comprehensive geological studies of the major basin areas of the world. A year later he was a Conorada vice president. He became president in mid-March this year.

When he isn't on a plane heading for a close look at some foreign geological prospect, Uhl makes his home in the Bronxville section of New York with his wife and two daughters, 10 and 23. He long ago had to give up golf and hunting and now confines himself pretty much to an occasional session of bowling in the evening.

His trips to Africa have given him a chance to do his only hunting in years, but he shrugs off any suggestion of "big game."

"Nothing much bigger than gazelle, so far," he says. He hasn't been able to come home with any heads or trophies either.

"Any time I've hunted, it's been in an area so remote there wasn't any way to preserve anything in the way of a trophy," he adds. "But the steaks are mighty good."

Personals

E. J. Gallagher, assistant general manager of British American Oil Co.'s production and pipeline department in Calgary, moves up to manager. He succeeds **O. I. Torkelsen,** vice president of the company, who has transferred to Toronto to assume executive duties relating to production and

E. J. GALLAGHER

O. I. TORKELSEN

pipeline operations. Gallagher had been assistant general manager of the department since 1956. Torkelsen was in charge of western Canadian exploration and production for British American before becoming general manager, production and pipeline, and a vice president in 1956.

H. R. Wall, Continental Oil Co., Houston, has been elected a director of Platte Pipe Line Co. He succeeds **A. W. Tarkington,** also of Continental.

Dan Williamson, manager of Transcontinental Gas Pipe Line Corp.'s land department, has been elected a vice president of the company. Williamson joined Transcontinental in 1949.

G. E. Stahl, manager of gas supply for Pioneer Natural Gas Co., has been elected a vice president of Pioneer Gathering System, Inc., a subsidiary. He will continue as manager of gas supply for the parent company.

W. A. Bruce, assistant chief of research at Jersey Production Research Co.'s Tulsa laboratories, has been appointed manager of the company's newly organized production division. **L. W. Welch, Jr.,** and **R. B. Chapman,** formerly section heads, have been named assistant managers of the production division. In other appointments, **Monroe W. Kriegel,** formerly head of the production engineering division, has been named director of technical placement. In the production division, **Charles D. Russell** becomes section head for reservoir research, with **D. M. Beeson** as section head for recovery research. **R. C. West** has been named section head, recovery engineering. **A. G. Weber** is reservoir-engineering section head.

Frederick M. Mayer, president of Continental-Emsco Co., Dallas, a division of Youngstown Sheet & Tube Co., has been elected a director of Youngstown. Mayer was elected a vice president of the parent company in 1956.

A. T. Rylands, Calgary division production manager for Shell Oil Co., has been transferred to Denver as division production manager. He succeeds **F. J. Toth,** who recently was named area production superintendent.

Arthur O. Hermodson, formerly mechanical engineer with Standard Oil Co. (Ind.), and **Edward M. Wuensch,** formerly chemical engineer with Allied Chemical & Dye Corp., have joined Arabian American Oil Co.'s engineering department in New York.

C. R. Goss, formerly division exploration superintendent with Richmond Petroleum Co. of Colombia, has been elected vice president and manager of Bolivian California Petroleum Co. Both are subsidiaries of Standard Oil Co. of California.

Russell B. Brown, general counsel of the Independent Petroleum Association of America, will receive the Texas Independent Producers and Royalty Owners Association recognition award at Tipro's annual meeting May 12. Brown has been general counsel of IPAA since 1930.

Frederick D. Marts has been appointed superintendent of Jayhawk Pipeline Corp. He was formerly with Panhandle Eastern Pipe Line Co. and Platte Pipe Line Co. **Edward P. Francken,** formerly with Gulf Oil Corp., has joined Jayhawk as administrative assistant. Marts will supervise construction of the Jayhawk system and after its completion will be manager of operations. Jayhawk plans to build a 242-mile, 10 and 12-in. crude line from southwestern Kansas to Wichita. The company is a joint venture of National Cooperative Refinery Association and Colorado Oil & Gas Corp.

Bob L. Galloway, superintendent of the new project development section in Cities Service Oil Co.'s gasoline division, has been named assistant to the division manager. **George C. Vaughan** will succeed Galloway in new projects. **Guy W. Duren** has been named to head the division's engineering and construction department. **L. T. Botts** will be superintendent of plant operations.

H. A. Shabaker has been named technical assistant to the president of the Houdry Process Corp. **Alexander K. Logwinuk** succeeds Shabaker in the foreign operations engineering staff.

Jesse R. Robertson, gang pusher for Cities Service Oil Co. in Odessa, Tex., has been promoted to assistant production foreman and transferred to Big Lake, Tex.

Robert R. Chase, formerly assistant superintendent at The Texas Co.'s El Paso, Tex., refinery, has moved up to superintendent. **Ralph B. Erwin,** chief process engineer at the Lockport, Ill., refinery, will succeed Chase as assistant superintendent in El Paso.

Cliff W. Peery, Mene Grande Oil Co. vice president, has moved into the top executive job in the Venezuelan company in a series of promotions which, for the first time, put two Venezuelans on Meneg's board of directors. Peery succeeds **I. G. (Grady) Davis,** a veteran of 23 years in Venezuela, who moves to Pittsburgh as a

C. W. PEERY

I. G. DAVIS

Gulf Oil Corp. vice president and coordinator of production for the parent company. **Thomas D. Lumpkin,** former head of Meneg's industrial relations, was named vice president. **Dr. Luis Alcala Sucre,** assistant to the vice president, and **Dr. Romero Zuloaga,** legal representative, both became members of the board of directors.

T. N. Duncan of N. V. Duncan Drilling Co., Fairfield, Ill., has been elected president of the Illinois Oil and Gas Association. His cabinet includes **O. F. Beaty,** Magnolia Petroleum Co., Mount Vernon, first vice president; **H. L. Brockman,** Calvert Drilling, Inc., Olney, second vice president; **M. H. Guess,** Shell Oil Co., Centralia, third vice president; **C. R. Collins,** Collins Brothers Oil Co., Mount Vernon, secretary; and **W. B. Price,** National Associated Petroleum Co., Mount Vernon, treasurer. **C. T. Smith,** Flora independent, is general counsel. **Charles J. Pardee,** Mount Vernon, is executive secretary.

Personals

J. Howard Rambin, Jr., vice president in charge of The Texas Co.'s domestic producing department, has been elected senior vice president in charge of Texaco's world-wide producing interests and activities. **A. W. Baucum,** general manager of the foreign producing department (Western Hemisphere and West Africa), will

J. H. RAMBIN, JR.

A. W. BAUCUM

succeed Rambin as vice president in charge of the domestic producing department. Rambin had been in charge of domestic producing for the past year. He joined the company in 1935. Baucum was assistant to the president before becoming general manager of the foreign producing department.

Henry E. Reif, group leader in catalytic pilot plant research and operation in Sun Oil Co.'s Marcus Hook, Pa., research and development division, has been named manager of the catalytic cracking section. He succeeds **Richard Fleming,** who has been transferred to the technical economics section. Sun has appointed section managers in three newly created positions. The new managers include **Dr. Paul E. Oberdorfer,** petrochemicals; **Dr. James L. Jezl,** applied research and **William P. Dugan,** sales service. Oberdorfer was formerly research chemist in fuel development. Jezl has been group leader in basic research, and Dugan was in the automotive laboratory.

Frank Gaines, Jr., has been appointed assistant eastern division production manager for Carter Oil Co. in Mattoon, Ill. Gaines was formerly assistant manager of Carter's employe-relations department in Tulsa.

Bruno Stolley, formerly manager of Shell Oil Co.'s Martinez, Calif., refinery, has been named general representative of the Royal Dutch-Shell company operating in the territory of Kalimantan, Indonesian Borneo.

M. R. Pitman, head of Creole Petroleum Corp.'s Caracas production department, will be proposed to stockholders as a director at the annual meeting May 23. If Pitman is elected, **Dr. Fred Baptista,** now assistant production manager, will succeed him in the top production job.

John F. Lynch, president of La Gloria Oil & Gas Co., has been elected a director of Texas Eastern Transmission Corp. Lynch has been associated with La Gloria, which became a subsidiary of Texas Eastern last year, since 1944. He has been president of the firm since 1947.

I. G. Davis, B. R. Dorsey, and **Joseph E. Bounds** have been elected administrative vice presidents of Gulf Oil Corp. **Archie D. Gray,** vice president and general counsel, becomes senior vice president. Davis, president since 1956 of Gulf's Venezuelan subsidiary, Mene Grande Oil Co., will move to Pittsburgh as administrative vice president for production. Dorsey, formerly coordinator in the manufacturing department, becomes administrative vice president, manufacturing. Bounds, general manager of the tax department since 1955, moves up to administrative vice president, tax department.

E. A. BROWN

E. A. Brown, Lone Star Gas Co.'s vice president in charge of exploration and gas supply, has been elected executive vice president, operations, a new position. **Carl M. Hill,** formerly superintendent of operations in the exploration and gas supply division, succeeds Brown as vice president, exploration and gas supply. **Thomas S. Bacon,** director of research and development, becomes vice president, research and development. **Willard G. Wiegel,** treasurer and director of personnel, has been named vice president, personnel.

J. B. Vaughan, division geologist for Ashland Oil & Refining Co., will resign June 1 to open consulting offices in Evansville, Ind.

Richard I. Galland, vice president and general counsel of Colorado Oil & Gas Corp., has been named president of American Petrofina Co. of Texas, operating division of American Petrofina, Inc.

Roy C. Williamson, manager of Sinclair Oil & Gas Co.'s Fort Worth division, and **Loren L. Ware,** general superintendent of exploration for Sinclair in Tulsa, have been elected vice presidents of the company. Williamson was president of Southern Production Co. before its purchase by Sinclair in 1956. Ware has been general superintendent of exploration for the past year.

DEATHS

Edward G. Thomas, 70, retired claims and right-of-way agent for The Texas Co., died April 23 in Tulsa. Thomas joined Carter Oil Co. soon after passing the Oklahoma bar examination in 1914. He later was with the old Marland Oil Co. in Ponca City, Okla., and joined Texas-Empire Pipe Line Co. in 1928. He was transferred to The Texas Co. in 1929.

S. Rush Bailey, 36, Los Angeles, chief geologist for Mohawk Petroleum Corp., was killed April 21 in the mid-air crash of a jet fighter and commercial airliner over Las Vegas. Bailey was on his way to Denver at the time of the accident.

W. J. McGlasson, 60, Illinois independent operator, died April 22 at his home in Thompsonville, Ill.

William Howard Hutchinson, 53, veteran driller in southern California fields, died at his home in Long Beach, Calif., recently after a long illness.

C. W. (Red) McMullin, 52, founder of McMullin Construction Co., Long Beach, Calif., died in a Long Beach hospital recently after a 2-year illness. McMullin's company built derricks and rigs in and around the Los Angeles Basin for years. McMullin himself engineered and pioneered rathole equipment for spudding in wells.

Ralph Brooks High, 71, Houston, retired vice president of Shell Pipeline Co., died April 29. High was first superintendent of Shell's Houston refinery. Later, as manager of the manufacturing department, he supervised construction of several of the company's U. S. refineries. He retired from Shell Pipeline in 1947.

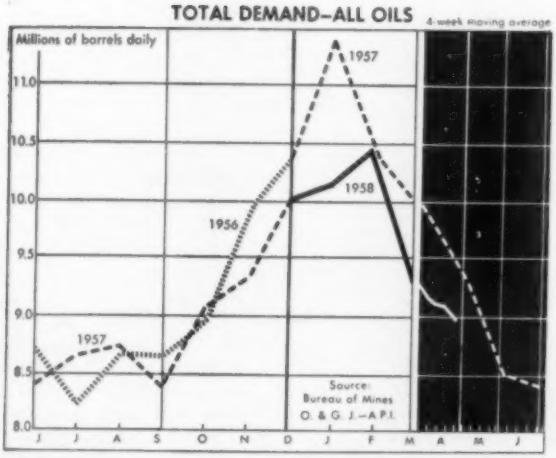
Virgil A. Manahan, 61, Ada., Okla., independent oil operator, died April 21 in Ada.

William B. Pyles, 71, retired transportation department manager for General Petroleum Corp., died April 25 in Los Angeles.

Latest Figures . . . Industry Trends

A QUICK LOOK AT THE HIGHLIGHTS

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	6,260,200	UP	5,275	DOWN	1,272,123
Crude stocks	279,290,000	DOWN	52,000	UP	22,209,000
Completions	858	UP	155	DOWN	118
Refinery runs	6,984,000	DOWN	67,000	DOWN	650,000
Gasoline stocks	207,147,000	DOWN	3,883,000	UP	6,925,000
Kerosine stocks	18,287,000	UP	750,000	DOWN	1,876,000
Distillate stocks	74,743,000	UP	1,683,000	DOWN	155,000
Residual stocks	57,600,000	UP	806,000	UP	20,800,000
Four-product stocks	357,777,000	DOWN	644,000	UP	25,694,000
Total imports	1,579,800	UP	389,200	UP	118,000



Product prices are shifting—some up, some down

PETROLEUM-PRODUCT MARKETS are moving in all directions. Distillate is the only major product with a steady price, and even here the market seems to be waiting for something to trigger a change.

Gasoline on the Gulf Coast has been gaining a little strength for the past few weeks. Prices were so low that large marketers found it more profitable to buy gasoline on the spot market than to increase runs at their own refineries. The resulting sales have taken the pressure off some of the independent refiners.

However, current market rumors seem to indicate a certain amount of indecision. No independent refiner in the area is selling gasoline at distress prices, but there are some unanswered questions that tend to keep the market jittery. Some of these are: How long will the large companies continue to buy gasoline on the open market? Will runs jump with the first increase in crude-production allowables? Do some of the larger refineries have surplus gasoline?

Heavy fuel has been reasonably firm on the Gulf Coast for the past 2 months. The market price has been very close to $2.25 a barrel. Spot sales probably have been no more than 5 cents to 10 cents off this base. The price has been high enough to promote tank-car shipments to the coast from Mid-Continent refiners.

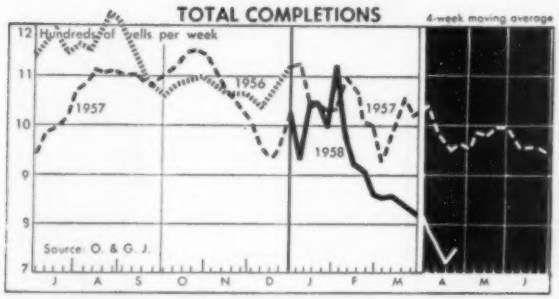
However, there is an unconfirmed rumor that heavy fuel is available in the Caribbean at a price that will make it available in the New York Harbor area under normal cargo quotations.

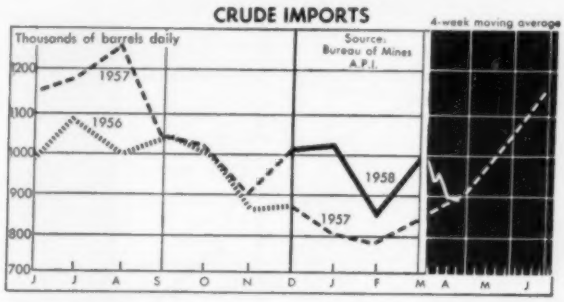
Distillate prices on the Gulf Coast will depend on marketers' summer-fill plans on the East Coast. The current barge price in New York Harbor is 8.85 cents a gallon. Any summer-fill plan with a discount of 0.5 cent a gallon would mean a price reduction on the Gulf Coast. Some market observers believe that summer-fill plans this year will be worked out without a direct discount.

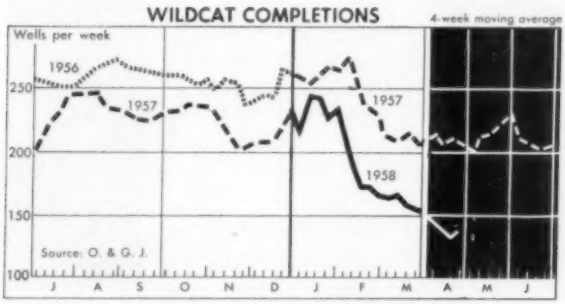
Gasoline spot prices are firming in the Group 3 area. One refiner reported an increase of 0.5 cent a gallon in spot gasoline prices for under-the-market sales. Some Group 3 regular gasoline has been sold to unbranded jobbers for as low as 10.5 cents a gallon plus transportation. The new quotation will result in a minimum of 11.0 cents per gallon if all suppliers meet it.

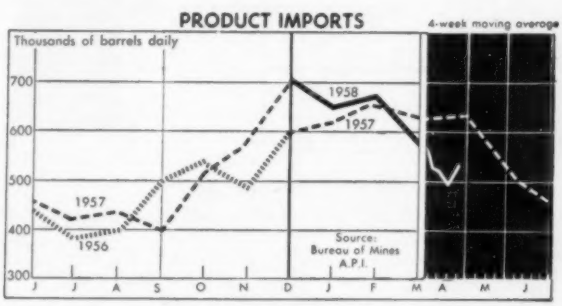
Refiners are now working out a price for the new Group 3 premium gasoline. In the pipeline, this gasoline will be called F Grade. It has an octane rating of 99.

It now looks as if the new premium will sell for 0.5 cent a gallon more than the old 98-octane premium. For the past several months there have been two prices on the old premium. Some refiners were selling for 2.5 cents a gallon above the price of regular gasoline. Others carried a differential of 2.75 cents over regular. For the present, there may be two prices on the new premium, each 0.5 cent over the quotation for the old premium.





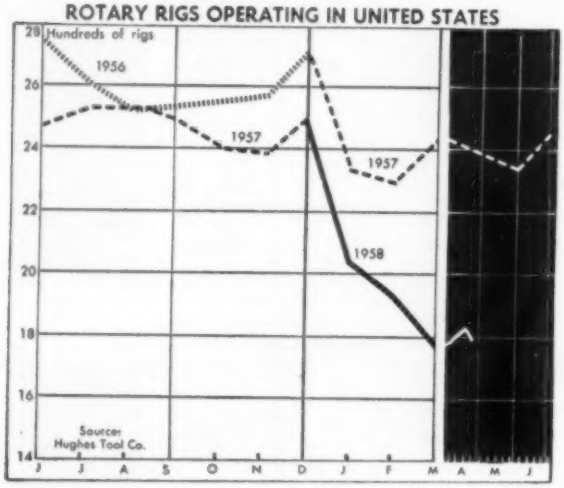




WEEKLY WELL COMPLETIONS . . . WEEK ENDED APRIL 26, 1958

	Total wells							Cumulative		Total wildcats					Cumulative	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1958	1957	Total	Crude	Cond.	Gas	Dry	1958	1957
Alabama	2	0	0	0	2	0	2,439	23	35	2	0	0	0	2	10	14
Arkansas	12	6	0	1	5	0	40,708	209	319	1	0	0	0	1	46	50
California	39	31	0	0	8	0	217,013	610	634	9	3	0	0	6	113	164
Colorado	9	1	0	1	7	0	45,705	228	302	4	0	0	1	3	118	202
Illinois	50	21	0	1	28	0	100,010	575	756	14	0	0	0	14	121	184
Indiana	13	4	0	0	8	1	19,564	201	199	2	1	0	0	1	74	42
Kansas	32	17	0	1	13	1	101,549	1,118	1,364	4	0	0	0	4	220	260
Kentucky	28	14	0	6	8	0	40,927	276	449	0	0	0	0	0	34	96
Louisiana	61	28	4	1	28	0	588,650	1,050	1,220	13	0	0	0	13	144	216
North	16	7	0	0	9	0	77,425	359	423	3	0	0	0	3	54	46
South	38	19	4	0	15	0	427,723	547	564	9	0	0	0	9	82	140
Offshore	7	2	0	1	4	0	83,502	144	233	1	0	0	0	1	8	30
Michigan	6	1	0	1	4	0	17,138	108	124	3	0	0	0	3	40	55
Mississippi	7	0	1	0	6	0	70,303	129	113	4	0	0	0	4	65	51
Montana	5	5	0	0	0	0	41,211	117	98	0	0	0	0	0	51	33
Nebraska	4	0	0	0	4	0	16,880	201	246	3	0	0	0	3	95	133
New Mexico	25	19	0	5	1	0	118,190	634	639	0	0	0	0	0	88	100
West	8	3	0	5	0	0	48,827	296	235	0	0	0	0	0	38	40
East	17	16	0	0	1	0	69,363	338	404	0	0	0	0	0	50	60
New York	10	5	0	0	0	5	13,500	175	149	0	0	0	0	0	13	0
North Dakota	10	6	0	0	4	0	63,328	132	94	2	1	0	0	1	43	35
Ohio	46	29	0	6	7	4	109,217	327	331	0	0	0	0	0	3	3
Oklahoma	113	61	3	6	38	5	421,148	2,129	2,166	19	1	1	1	16	278	243
Pennsylvania	0	0	0	0	0	0	0	32	322	0	0	0	0	0	6	20
Texas	360	190	14	16	138	2	1,521,407	5,818	7,037	75	6	1	1	67	1,206	1,844
Dist. 1	50	22	3	2	23	0	164,836	316	412	11	0	0	0	11	115	145
Dist. 2	17	6	2	2	7	0	91,829	221	228	4	0	0	0	4	56	92
Dist. 3	23	5	1	2	15	0	123,610	399	588	5	0	1	0	4	74	197
Dist. 4	29	3	3	3	20	0	148,289	388	456	11	0	0	0	11	115	171
East	23	12	0	0	11	0	88,446	410	413	7	0	0	0	7	116	129
Dist. 7-B	44	17	1	1	25	0	126,493	760	917	13	0	0	1	12	222	328
West	101	84	1	1	14	1	530,407	1,737	1,996	12	4	0	0	8	250	304
Dist. 9	57	32	1	1	22	1	175,393	1,175	1,593	11	2	0	0	9	224	446
Dist. 10	16	9	2	4	1	0	72,104	412	434	1	0	0	0	1	33	32
Utah	13	9	0	0	4	0	67,670	148	55	4	0	0	0	4	29	34
West Virginia	7	1	0	5	1	0	22,866	216	207	1	0	0	0	1	8	9
Wyoming	6	3	0	1	2	0	25,338	242	255	0	0	0	0	0	75	92
Miscellaneous	0	0	0	0	0	0	0	34	25	0	0	0	0	0	28	20
Total U. S.	**858**	451	22	51	316	18	3,664,761	14,732	17,139	**160**	12	2	3	143	2,908	3,910
Total prev. week	703	363	32	48	240	20	3,082,668	.....	.....	127	12	5	2	108	.....	.....
Cum. 1958	14,732	7,382	361	1,084	5,586	319	62,836,285	.....	.....	2,908	270	46	100	2,492	.....	.....
Western Canada	33	16	0	4	10	3	185,101	783	832	11	0	0	3	8	297	229

ROTARY RIGS OPERATING IN UNITED STATES



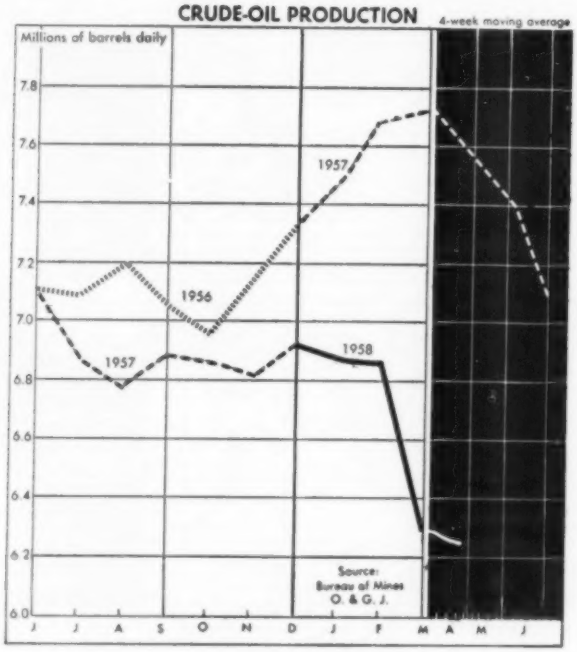
ACTIVE ROTARY RIGS*

	4-28-58	4-21-58	4-14-58	4-29-57
Alabama	5	4	4	11
Arkansas	16	17	15	23
Arizona	....	....	....	1
California	70	66	65	89
Colorado	25	25	25	40
Florida	1	1	1	2
Georgia	....	....	....	....
Idaho	....	....	....	....
Illinois	33	42	35	51
Indiana	10	6	6	4
Iowa	3	3	3	2
Kansas	120	129	109	169
Kentucky	5	3	3	5
Louisiana	306	307	300	420
North	36	35	38	53
South	219	222	211	266
Offshore	51	50	51	101
Maryland	....	....	....	....
Michigan	9	10	8	10
Missouri	....	....	....	1
Montana	21	24	23	25
Mississippi	34	36	37	34
Nebraska	20	17	13	41
Nevada	....	....	....	....
New Mexico	123	115	110	136
New York	....	....	1	1
North Dakota	32	33	37	25
Ohio	....	....	....	....
Oklahoma	192	194	195	221
Oregon	....	....	....	1
Pennsylvania	12	12	11	11
South Dakota	....	....	....	2
Texas	670	705	727	948
Gulf Coast	153	173	177	186
Offshore	2	3	5	6
West	262	285	289	378
North	215	205	227	321
East	38	39	29	57
Tennessee	....	....	....	....
Utah	34	31	32	34
Washington	1	1	2	....
West Virginia	4	4	4	1
Wyoming	45	46	43	64
Virginia	....	....	....	....
Total United States	1,791	1,831	1,810	2,372
Western Canada	78	75	84	101
Eastern Canada	1	1	1	2
Grand total	1,870	1,907	1,895	2,475

*Hughes Tool Co.

CRUDE-OIL PRODUCTION

4-week moving average

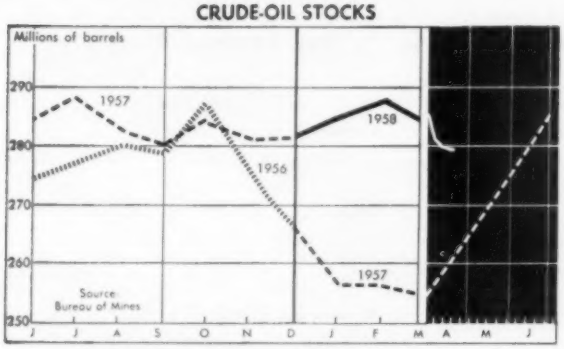


DAILY AVERAGE PRODUCTION FOR WEEK

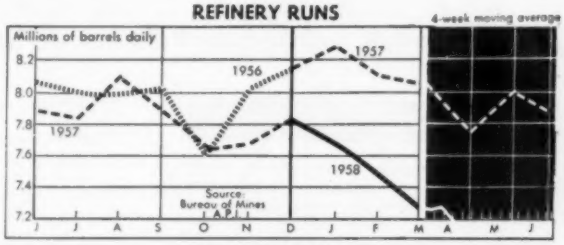
	April 26, 1958			April 19
	Crude oil	Lease condensate	Total	total
Alabama	21,200	.....	21,200	16,100
Arkansas	83,500	200	83,700	81,700
California	869,300	.....	869,300	874,100
Colorado	139,975	.....	139,975	139,350
Eastern	48,600	.....	48,600	48,800
Florida	1,275	.....	1,275	1,275
Illinois	224,300	.....	224,300	219,000
Indiana	29,600	.....	29,600	30,100
Kansas	†341,950	.....	†341,950	†327,525
Kentucky	42,700	.....	42,700	43,900
Louisiana	736,000	87,875	823,875	826,125
North	111,000	3,000	114,000	116,250
South	625,000	84,875	709,875	709,875
Michigan	24,400	.....	24,400	23,800
Mississippi	98,350	5,000	103,350	103,350
Montana	73,500	.....	73,500	73,600
Nebraska	52,250	.....	52,250	52,125
Nevada	100	.....	100	100
New Mexico	252,075	6,800	258,875	258,875
North Dakota	31,250	.....	31,250	36,000
Oklahoma	†551,200	.....	†551,200	†560,300
Texas	2,157,500	63,900	2,221,400	2,221,400
Dist. 1	45,000	400	45,400	45,400
Dist. 2	89,000	9,100	98,100	98,100
Dist. 3	316,000	32,000	348,000	348,000
Dist. 4	157,500	7,600	165,100	165,100
Dist. 5	27,000	400	27,400	27,400
Dist. 6	96,000	7,400	103,400	103,400
East Texas field	117,000	.....	117,000	117,000
Dist. 7-B	129,000	100	129,100	129,100
Dist. 7-C	110,000	3,550	113,550	113,550
Dist. 8	775,000	1,500	776,500	776,500
Dist. 9	189,000	1,200	190,200	190,200
Dist. 10	107,000	650	107,650	107,650
Utah	16,900	.....	16,900	12,700
Wyoming	300,350	.....	300,350	304,550
Others	‡150	.....	‡150	‡150
Total U. S.	6,096,425	163,775	**6,260,200**	6,254,925
Change from prev. week, up			**5,275**	.....
Canada	†409,800	.....	†409,800	†442,800
Total U. S. production, Jan. 1-April 26				762,700,925 bbl.
Same period last year (crude plus cond.)				*882,351,390 bbl.

*Includes 16,717,250 bbl. condensate. †Week ended previous Monday. ‡South Dakota.

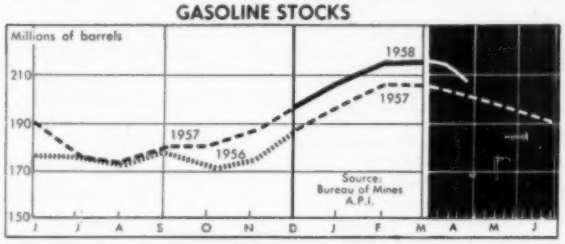
CRUDE-OIL STOCKS



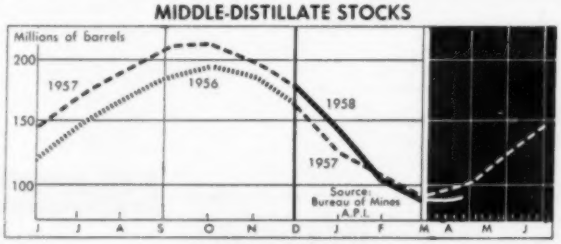
REFINERY RUNS



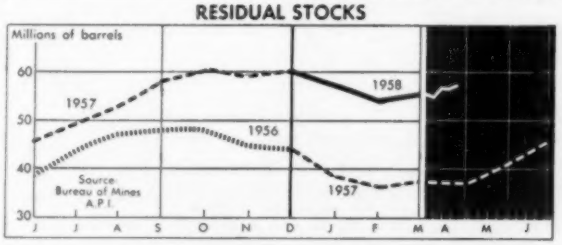
GASOLINE STOCKS



MIDDLE-DISTILLATE STOCKS



RESIDUAL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	4-19-58	4-12-58	4-20-57
Pennsylvania Grade	2,862	2,884	2,696
Other Appalachian	1,653	1,351	1,890
Illinois, Indiana, and Michigan	9,955	9,871	9,276
Nebraska and North Dakota	2,793	2,578	1,894
Kansas	10,239	10,051	8,966
Oklahoma	18,150	17,450	22,437
Arkansas	2,654	2,598	2,753
Louisiana	17,730	17,679	17,877
North	2,723	2,714	2,828
South	15,007	14,965	15,049
Mississippi, Alabama, and Florida	2,399	2,448	2,225
New Mexico	8,034	8,008	7,204
Texas	124,219	126,034	118,521
East Texas	7,974	8,323	10,822
West Texas	57,415	57,653	55,606
Texas Gulf	25,211	25,581	21,713
Other Texas	33,619	34,477	30,380
Wyoming	15,926	15,520	16,689
Other Rocky Mountain	7,282	7,094	6,330
California	38,787	38,394	25,578
Foreign	†16,607	17,382	12,745
Total	279,290	279,342	257,081

*Bureau of Mines. †Includes 3,900,000 bbl. in California.

API REFINERY REPORT—APRIL 25, 1958

(Thousands of barrels)

District—	Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.	Stocks‡—Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, April 1957—Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.
East Coast	991	448.6	33.2	260.4	160.4	46,320	6,820	22,049	11,189	1,187	483.8	34.0	315.7	212.5
Appalachian:														
District 1	75	28.1	5.4	17.7	4.7	5,095	577	1,822	625	96	39.7	5.5	19.2	7.2
District 2	80	38.9	3.9	14.0	6.2	2,519	337	764	479	106	51.7	5.0	15.2	13.5
Ind., Ill., Ky.	1,221	626.0	64.3	259.7	140.7	39,278	3,581	10,989	4,415	1,284	667.5	62.8	268.2	158.4
Minn., Wis., Dak.	99	47.7	9.2	22.7	9.2	6,443	526	3,545	551	87	41.2	5.2	23.2	7.7
Okla., Kans., Mo.	605	325.1	15.3	139.4	24.7	18,770	968	6,100	867	629	353.6	17.8	140.2	29.6
Inland Texas	282	199.9	11.6	48.9	17.3	7,797	338	1,282	2,007	251	190.6	7.5	50.9	20.5
Texas Gulf Coast	1,701	844.6	93.7	449.7	182.3	26,962	2,039	8,293	4,266	1,954	871.6	78.8	493.9	223.9
La. Gulf Coast	567	321.0	39.2	135.0	34.0	11,836	1,685	3,705	1,167	664	332.7	56.5	177.0	53.5
N. La. and Ark.	93	42.3	8.1	18.3	8.0	5,386	835	1,479	123	66	25.0	3.8	16.5	5.3
Rocky Mountain:														
New Mexico	24	11.4	1.0	4.7	2.9	381	14	133	89	28	15.3	0.4	5.4	2.4
Other Rocky Mtn.	217	97.4	1.1	49.6	29.6	7,551	184	2,590	911	239	112.6	1.4	56.4	33.8
West Coast	1,029	460.4	12.6	143.2	287.9	28,809	383	11,992	30,911	1,149	501.8	5.3	182.7	363.8
Apr. 25, 1958	6,984	3,491.4	298.6	1,563.3	907.9	207,147	18,287	74,743	57,600	7,740	3,687.1	284.0	1,764.5	1,132.1
Apr. 18, 1958	7,051	3,504.4	274.0	1,557.3	927.8	211,030	17,537	73,060	56,794	.....	.....	.....	.....	.....
Apr. 26, 1957	7,634	3,744.4	235.4	1,764.6	1,191.3	200,222	20,163	74,898	36,800	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-Oil and Refinery Prices at Representative U. S. and Foreign Points

REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):	
Regular (89 octane)	11.00-11.50
Premium (98 octane)	13.75-14.25
Gulf Coast (cargoes for coastwise or export movements):	
Regular (90 octane)	9.75-10.25
Regular (92 octane)	10.00-10.50
Premium (97 octane)	11.375-11.75
Premium (98 octane)	11.875-12.50
California (rack) (Los Angeles):	
Regular (88 octane)	12.0
Premium (96 octane)	14.5
Premium (98 octane)	15.0
Caribbean area (cargoes):	
Regular (87 octane)	9.625
Premium (98 octane)	12.125

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

NATURAL GASOLINE*

Group 3:	
Grade 26-70	4.5
Breckenridge:	
Grade 26-70	4.0

*If 26-70 natural is considered as 100 per cent, prices for lower-vapor-pressure grades increase 2.5 per cent for each unit drop in Reid vapor pressure down to and including 16 lb. Prices for grades below 16 lb. may vary slightly by areas or plants.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):	
Kerosine 42-44	9.25-9.50
Diesel oil (58 d.i. and above)	8.875-9.125
Distillate No. 1	8.875-9.125
Distillate No. 2	8.25-8.50
Gulf Coast (cargoes):	
Kerosine 41-43	8.50-8.75
Distillate No. 2	8.00-8.25
New York Harbor (barges):	
Kerosine 41-43	9.35
Distillate No. 2	8.85
Diesel fuel, 48-52 d.i.	9.45
Caribbean area (cargoes):	
Distillate No. 2	8.125

WAX (LB.)

Oklahoma (Group 3):	
132-135 A.m.p. (semi-refined) in tank cars	6.50
New York (export):	
126-130 A.m.p. crude-scale (solid in bags or barrels)	7.35

★Denotes change from previous week.

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):	
Residual fuel (max 1% S)	$1.25-1.30
Gulf Coast (cargoes):	
Bunker C fuel	$2.25-2.40
New York Harbor (barges):	
Bunker C fuel	$2.65
Caribbean (cargoes):	
Bunker C	$2.25
California (rack):	
Bunker C fuel, Los Angeles	$2.45

LUBRICATING OILS

Mid-Continent (Group 3):	
150-160 bright stock, solvent refined, 0-10 p.p., 95 v.i.	23.0
200 vis. neutral oil, solvent refined, 0-10 p.p., 95 v.i.	20.5
Pennsylvania Grade:	
145-155 vis. at 210, bright stock, 8 color, 25 p.t.	26
200 vis. neutral (180° at 100°), 25 p.t.	24

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.	Mid-Cont.*	Gulf Coast Tex.†	West Tex.‡ N.M.	Wyo. (sour)
14-14.9	$2.47	....	....	....	....
15-15.9	2.52	....	....	....	$1.81
16-16.9	2.58	....	....	....	1.86
17-17.9	2.63	....	....	....	1.91
18-18.9	2.69	....	....	....	1.96
19-19.9	2.74	....	....	....	2.01
20-20.9	2.80	$2.75	....	$2.62	2.06
21-21.9	2.85	2.77	....	2.64	2.11
22-22.9	2.91	2.79	....	2.66	2.16
23-23.9	2.96	2.81	$3.44	2.68	2.21
24-24.9	3.02	2.83	3.46	2.70	2.26
25-25.9	3.07	2.85	3.48	2.72	2.31
26-26.9	3.13	2.87	3.50	2.74	2.36
27-27.9	3.17	2.89	3.52	2.76	2.49
28-28.9	3.22	2.91	3.54	2.78	2.54
29-29.9	3.27	2.93	3.56	2.80	2.59
30-30.9	3.32	2.95	....	2.82	2.63
31-31.9	3.38	2.97	....	2.84	2.67
32-32.9	3.44	2.99	....	2.86	2.71
33-33.9	3.50	3.01	....	2.88	2.75
34-34.9	3.56	3.03	....	2.90	2.79
35-35.9	3.61	3.05	....	2.92	2.83
36-36.9	3.65	3.07	....	2.94	2.87
37-37.9	3.68	3.09	....	2.96	2.89
38-38.9	....	3.11	....	2.98	2.91
39-39.9	....	3.13	....	3.00	2.93
40 and up	....	3.15	....	3.02	2.95

*Includes Oklahoma (sweet), part of Kansas, North Dakota, W. Texas (sweet). Some Oklahoma available for 15 cents less starting 3-17-58 and other at 10 cents less on 4-1-58. †Low cold test crude. ‡Sour.

Effective dates of broad changes: California, 4-14-58; east of California, January 3-10, 1957; Pennsylvania Grade 4-16-58.

FLAT PRICES

Louisiana:	
Bienville (distillate)	$3.05
Ville Platte	3.45
Texas:	
East Texas	3.25
Conroe	3.53
Van	3.08
Pennsylvania Grade:	
Bradford	4.15
Middle District	3.97
Southwest Pennsylvania	3.68
West Virginia	3.50
Buckeye Grade	3.50
Illinois Basin	3.00
Canada:	
Leduc-Woodbend	2.67
Redwater (Alta.)	2.56
Smiley (Sask.)	2.33
Pembina	2.54

FOREIGN

Venezuela:	
Cumarebo, 48°-49.9°, Tucupido	3.75
San Joaquin, 41°-41.9°, Puerto La Cruz	3.34
Oficina, 35°-35.9°, Puerto La Cruz	3.05
Tia Juana medium, 26°-26.9°, Amuay*	2.55
Quiriquire, 16.0°-16.4°, Caripito	2.30
Lagunillas heavy, flat, Amuay or Las Piedras*	2.25
Bachaquero, flat, 15°-16°, Las Piedras*	2.08

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Middle East, Persian Gulf (cargoes, f.o.b. lifting port):	
Arabian, 36.0°-36.9°, Ras Tanura	$2.12
Iranian, 34.0°-34.9°, Bandar Masur	2.04
Iranian, 34.0°-34.9°, Abadan	1.99
Iraq, 35.0°-35.9°, Fao	1.98
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.85
Qatar, 41.0°-41.9°, Umm Said	2.23
Middle East, E. Mediterranean:	
Arabian, 36.0°-36.9°, Sidon	2.49
Iraq, 36.0°-36.9°, Tripoli, Banias	2.49
Far East (cargoes, f.o.b. Lutong, Sarawak):	
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FOREIGN EMPLOYMENT. List oil companies, drilling contractors, seismograph contractors, showing where apply foreign jobs, $5.00 cash. OIML Co., Box 2603, Tulsa, Okla.

SITUATION WANTED

FOREIGN JOB—Rotary Driller and tool pusher—20 years experience. References on request. Phone MOhawk 5-2357, Box 16, Wynnewood, Oklahoma.

GEOLOGIST: Master's, 27, some foreign and domestic work but no solid experience. Reliable, eager to learn. All sciences, calculus, many commercial courses. Seek domestic employment. For resume please write Box K-653, The Oil and Gas Journal, Tulsa, Oklahoma.

ENGINEER-MANAGER: Aggressive and experienced Administrator with twenty years broad refining and diversified oil industry background. Successful domestic and foreign negotiating, organizing, planning, staffing and operations. Proven ability direct efforts others and control costs Degree. Immediately available. Box K-669, The Oil and Gas Journal, Tulsa, Oklahoma.

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JUNIOR HOUSE or Tax Counsel, 34; 5 years general practice; complete University Southern California graduate law tax courses, oil and gas, in June. Resume. Box K-684, The Oil and Gas Journal, 4041 Marlton Ave., Los Angeles 8, California.

LANDMAN—Major and Independent management and field experience all phases from records to trading and Federal Units. Seven years in Mid-Continent, Rockies, Denver and Williston Basins. Married, 37, LLB, will relocate. Job should require work and initiative. Inquiries Confidential. Available Immediately. Box K-678, The Oil and Gas Journal, Tulsa, Oklahoma.

ADMINISTRATOR AND LANDMAN, young man, 32, single, neat, personable, nine years experience in oil industry including marketing, transportation, production, exploration, land, lease, accounting, shorthand, desires position aggressive Denver independent. Can qualify as executive assistant, office manager, landman, assemble deals, etc Excellent references. Box K-679, The Oil and Gas Journal, Tulsa, Oklahoma.

Public Relations Man

Presently employed by large paper and food packaging manufacturer, with experience in oil and aircraft industries, seeks supervisory opportunity in public relations or employee communications-publications. Age 34. Married. Degree. Travel. Salary open. Prefer midwest or southwest. Best references.

Box K-672,
The Oil and Gas Journal,
Tulsa, Oklahoma.

SITUATION WANTED

OIL EXECUTIVE, young, capable; 20 years experience with large independents in all phases of oil business. Former Assistant Director API; trades, titles, land and lease; scouting and geological background; correspondence and contract expert. Vast knowledge of royalties, blocks, drilling and reserves. Accounting, taxes and public relations. Last employer sold production and quit business. Desires association with active independent. Married, no children. Will go anywhere at own expense for interview and will relocate. Best references. Salary commensurate with ability. Box K-680, The Oil and Gas Journal, Tulsa, Oklahoma.

OIL SCOUT (I hope). Eager to learn, like travel, energetic, married, 23, degree—geological background, any location, salary no object for right opportunity. Presently employed by midwestern gas company. Stephen Bowen, Huron, Ohio.

THE POSITION YOU WANT: Oil Industry companies are looking for men to fill every conceivable kind of position. If you didn't find the position in this column that you are looking for, use a "Situation Wanted" classified advertisement to state your qualifications. Some company is probably looking for your ability. See box heading for classified rates or write The Oil and Gas Journal, Tulsa, Oklahoma.

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ATTENTION: PURCHASERS OF OIL AND GAS MINERALS!
Would like to hear from pension trust or foundation officers, who are interested in purchasing producing oil and gas minerals. Please do not answer if you are not the principal who is in position to purchase these minerals.

Box K-674, The Oil and Gas Journal, Tulsa, Oklahoma.

PRODUCTION WANTED

WANTED: Oil properties, 100 to 5,000 barrels daily in Oklahoma and Kansas. Morris Sitrin, P. O. Box 1160, Tulsa, Okla.

WISH TO PURCHASE producing oil wells and landowners' or overriding royalties for cash. Submit all pertinent information. Elgee Oil Company, 1380 First National Office Building, Oklahoma City, Okla.

EASTERN CAPITAL seeking sizable oil-gas properties. Fair prices. Quick action. Box K-652, The Oil and Gas Journal, Tulsa, Oklahoma.

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APPALACHIAN BASIN—Weekly scout reports; exploration and development—New York, Pennsylvania, West Virginia and Maryland. For information write: H. & R. SCOUTING SERVICE, Box 312, Coudersport, Penna.

FOREIGN SCOUTING SERVICE

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Bahamas	Brit. Honduras	Nicaragua
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COLLECTION OF PERTINENT DATA
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Consulting Geologists
Sinclair Bldg., Havana, Cuba

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P. O. Box 1260 — Tulsa, Okla.

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PRODUCING COMPANY would like to purchase good producing leases and royalties having some undeveloped locations. Any submitted must be accompanied with complete information and price. Box K-647, The Oil and Gas Journal, Tulsa, Oklahoma.

ALASKA: May I assist you file for your lease block? Your total costs 50c per acre. Lloyd E. Honsinger, 1702-J Twining Avenue, Anchorage, Alaska.

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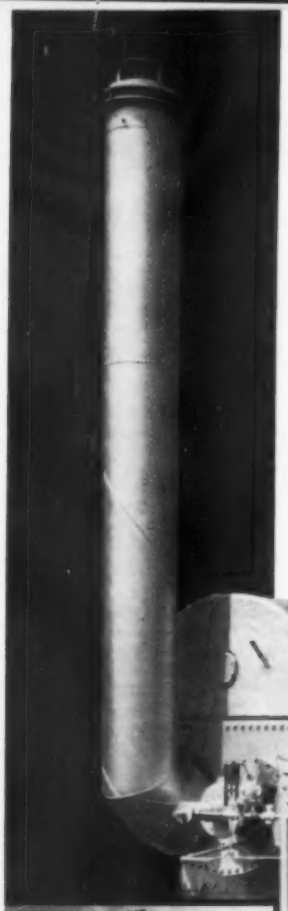

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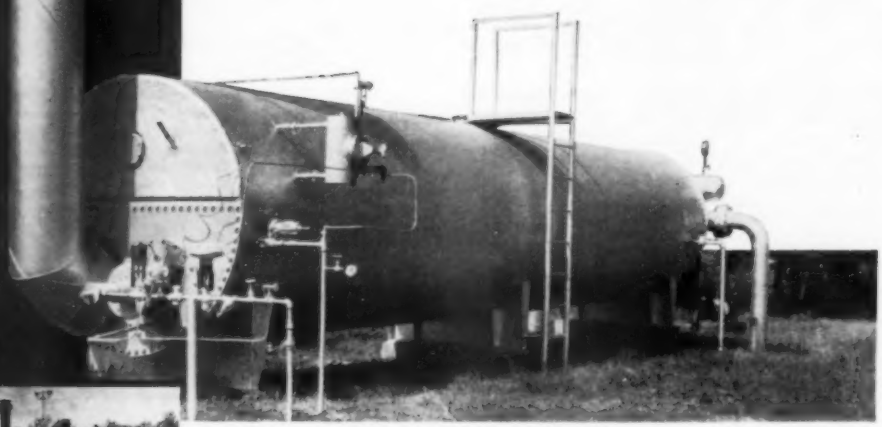

In an East Texas field during the winter months, it was necessary to man a pump station 24 hours a day. The station was pumping 2,760 BOPD with part of the crude bypassing through a relief valve to the pump suction. The high line pressure of 920 psi and automatic bypassing of the pump was caused by pumping cold viscous crude. Under these conditions, the station was handling only about 50% of the field allowable which was a 50% curtailment in production.

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Oil outlet temperature	118 F.
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Oil outlet pressure, heater	680 psi
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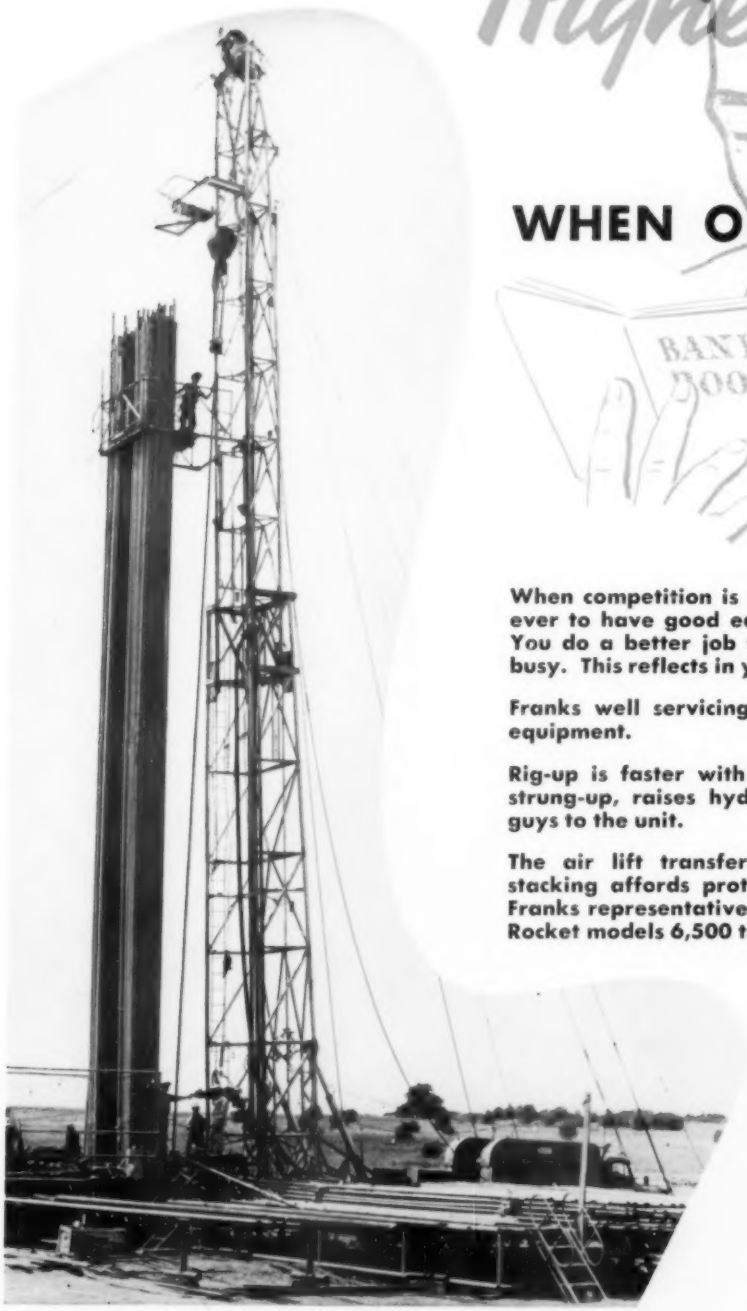

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